

1560/112.

THE
MARINERS
New Calendar.

BOOKS of Navigation, Printed for Richard Mount.

- THE Coasting Pilot for *England, Scotland, Ireland, Holland, Flanders, &c.*
 The Eng. Pilot for the Channel. English Pilot for the Northern Sea.
 The Eng. Pilot for the Straights.
 The English Pilot for the *West-Indies*. English Pilot for the *East-Indies*.
 The Mariners Magazine; containing the Art of Navigation Surveying, Gauging, Gunnery, Astronomy, Dyalling, and Fortification by *Cap. Samuel Sturmy*.
Sea-Atlas, containing Charts of the Sea-Coasts of the whole World.
 The Mariners New Kalendar. By *Nathaniel Colson*.
 The Seaman's Ka'endar. By *Henry Philips*.
 The Seaman's New Kalendar. By *William Leybourne*.
 The Seaman's Practice. By *Richard Norwood*.
Norwood's Doctrine of Triangles, (with Logarithms) applied to Navigation.
 Seamans Dictionary. By *Sir Henry Manwaring*.
 Practical Navigation, by *John Seller*.
 The whole Art of Navigation. By *Capt. Daniel Newhouse*.
 A Light to the Art of Gunnery, By *Capt. Thomas Binning*.
 The Safeguard of Sailors; describing the Sea-Coasts.
 Advancement of the Art of Navigation. By *Henry Phillips*.
 Theoretical Navigation. By *Ja. Hodgefon*.
 Art of Defensive Sea-fighting.
 The Compleat Modelist, or Art of Rigging; shewing how to raise the Model of any Ship; and to find the Length and Bigness of every Rope in all Vessels, with the weight of their Anchors and Cables. By *T. Miller*.
 The Boatwain's Art; shewing the Art of Rigging any Ship, &c.
 The Compleat Ship-wright; teaching the Proportions used by Ship-wrights, according to their Custom of Building; with the drawing of a Draught the making and marking of a Bend of Moulds, with a Table of Squares. By *Edm. Bushnel*, Shipwright.
 The Geometrical Seaman, shewing the 3 kinds of Sailing. By *H. Phillips*.
 The Seaman's Companion. By *M. Norwood*.
 The Seaman's Glass, shewing the use of the Plain Scale in Navigation.
 Seaman's Grammer. By *Capt. John Smith*.
 Sea-Dialogues, and a Dictionary explaining all the parts of a Ship, with the words of Art and Phrases used at Sea. By *Capt. Boteler*.
 An Epitome of the whole Art of Navigation. By *James Atkinson*.
 Epitomy of Navigation, shewing the Doctrine of Triangles, and all three Kinds of Sailing; Astronomy and Geography, with useful Tables in Navigation. By *H. Gellibrand*. with Large Additions. By *James Atkinson*.
Norwood's Epitomy. With Additions, by *James Atkinson*.
 An Epitomy of the Art of Navigation. By *William Jones*.
 The Compleate Sea Gunner.
 The Mariners Compass Rectified. By *A. Wakely*, much enlarged by *J. Atkinson*.
 The use of the double Scale of Proportion. By *Seth Partridge*.
 A Key to Arithmetick and Algebra. By *John Parsons*.
 The Seaman's Tutor. By *Peter Perkins*.
 Mathematical Manuel; of Navigation, Gunnery, Dyalling, &c. By *H.P.*
 Arithmetical Trigonometry, with the Construction or Making the Tables of Logarithms, Sines, and Tangents. By *Mark Forster*.
 Square and Cube Root compleated. By *Peter Halliman*.
 There are also sold all sorts of Mathematical and Sea-Books, Sea-Charts for all parts of the World; or Books of any other Subjects; all sorts of Paper, or Paper-Books; the best Ink, and other Stationary Ware, at Reasonable Rates.

T H E
MARINERS
New Kalendar.

Containing
The Principles of Arithmetick and Geometry; with the
Extraction of the Square and Cube Roots. Also Rules
for finding the Prime, Epact, Moon's Age, Time of
High-Water, with Tables for the same.

Together with
Exact Tables of the Sun's Place, Declination, and Right Ascension.
Of the Right Ascension and Declination of the Principal Fixed-
Stars. Of the Latitude and Longitude of Places. A large
Table of Difference of Latitude and Departure, for the exact
Working a Traverse.

A L S O
The Description and Use of the Sea-Quadrant, Fore-staff and No-
cturnal. The Problems of Plain-Sailing and Astronomy, wrought
by the Logarithms, and by *Gunter's* Scale. A Tide Table. The
Courses and Distances on the Coast of *England, Scotland, Ireland,*
France, &c. And the Soundings coming into the Channel.
With Directions for sailing into some Principal Harbours.

By Nathaniel Colson, *Student in the Mathematicks.*

Whereunto is added Sailing by *Mercator's* Chart.

By JOHN COLSON, *Teacher of the Mathematicks.*

London, Printed for *Richard Mount*, at the Postern on Tower-Hill; 1706.
Where you may have all sorts of Mathematical and Sea-Books.

To the Ingenious Mariner.

I Here present thee with a New Kalendar, wherein I have endeavoured not to puzzle thee with unprofitable Problems (a thing too much practised) but to make things plain and practicable. Here's nothing obscure or difficult, to discourage young Beginners (for whom 'tis intended) but all things treated of with as much Plainness (both of Matter and Method) as Possible; and I assure thee, were I present to instruct thee, I could by no means render things more intelligible than I have here done. I have endeavoured to omit nothing that might be materially useful, having respect to the designed Bigness of the Volume. The Contents are as follow:

The Principles of Arithmetick, with which I begin, because I am sensible of the loss some have been at, that have attempted Navigation before they have understood something of it, the Extraction of the Square and Cube Roots: in all which I have endeavoured to apply the Examples to Sea-Affairs. Some necessary Geometrical Problems, useful in Navigation. Directions for finding the Prime, Epact, Moon's Age, and the Time of Full Sea (both according to the ordinary, and a more accurate Way) with Tables for the same.

Tables of the Sun's Place and Declination, with Directions and Examples of every Case, how to use the Declination, to find the Latitude: As also the necessary Tables for correcting the Declination, when the Difference of Longitude is considerable from the Meridian of London, for which the said Tables of Declination are calculated. A Table of the Sun's Right Ascension. A Table of the Right Ascension and Declination of some of the principal Fixed Stars: with the use of the said Tables in finding the time of a Star's coming to the Meridian; as also Directions at large for Observation of any of the said Stars, to find the Latitude of the Place, with Examples in each Case. The Description and Use of the Sea-Quadrant, Fore-Staff, and Nocturnal. A Table of Latitude and Longitude of the principal Places on the Sea-Coast, collected from the best Information, Problems of Plain-Sailing and Astronomy, which (that the Practitioner might learn two things at once) are wrought both by the Logarithms, and Gunter's Scale. A large and very useful Table of Difference of Latitude and Departure, to every Degree and Quarter-Point of the Compass: With its Use in working a Traverse, in order to keep a Reckoning at Sea. A Rutter for the Coast of England, Scotland, France, Ireland, Spain, Portugal, &c. shewing the Bearing and Distance from one Place to another. A Table of the Soundings coming into the Channel, giving the Depth of Water, and Quality of the Ground. Lastly, Directions for sailing into some principal Harbours. By all or any of which, if thou art any ways profited (as I know thou may'st, if thou wantest Information in any of these Things, and do'st but a little carefully animadvert upon what thou reade'st) I have my end; and thy kind Acceptance hereof will further oblige me,

Who am thy Friend,

Nathaniel Colson.



*The Principles of Arithmetic briefly and plainly demonstrated
With the Extraktion of the Square and Cube Roots.*

BEcause of the Usefulness and Necessity of some knowledge of *Arithmetic* in the Art of *Navigation*, it is requisite to begin with that, without which no orderly Procedure can be made; and first of **Numeration.**

Numeration is that part of *Arithmetic*, whereby one may rightly express the value of any Number proposed.

All Numbers are expressed by these Characters following :

1, 2, 3, 4, 5, 6, 7, 8, 9, 0.
One, Two, Three, Four, Five, Six, Seven, Eight, Nine, Cypher.

Altho Cyphers signify nothing by themselves, yet being put before (or to the right hand of) other figures, they increase their Value as much as if they were all Figures, as may plainly be seen in the Table following.

1	Units	1
12	Tens	10
123	Hundreds	100
1234	Thousands	1000
12345	X Thousands	10000
123456	C Thousands	100000
1234567	Millions	1000000
12345678	X Millions	10000000
123456789	C Millions	100000000

Figures have their value according to their places they are set in; As in the first place, or place of *Units*, is *One*; in the second place *Ten*; in the third place *One Hundred*; in the fourth place *One Thousand*; in the fifth place *Ten Thousand*, &c.

The Table directs how properly to express any given Number; As 123, which Number consisting of 3 places, is thus numbred, *One Hundred twenty three*; this Number 123456, consisting of 6 Places, is thus expressed, *One hundred twenty three thousand, four hundred fifty six*; and this Number 123456789, consisting of nine places, is thus numbred, *One hundred twenty three Millions, four hundred fifty six thousand, seven hundred eighty nine.*

Addition.

Addition.

Addition is that which of several Sums makes but one Sum,

Example Suppose four Men (A. B. C. D.) owe me several Sums of Money, I would know how much is due to me in the whole: I begin at the first row towards the right hand, and say 3 and 6 is 9, and 2 is 11, and 4 is 15; setting down the 5 under the row added up: then I carry the 1 ten to the next row, saying, 1 and 4 is 5, and 5 is 10, and 3 is 13, and 6 is 19, set down 9 under the row added up, and carry 1 to the next row, saying, 1 and 8 is 9, and 1 is 10, and 4 is 14, and 5 is 19; set down 9, and carry 1, which 1 and 1 is 2, and 3 is 5, and 5 is 10, and 3 is 13; which because this is the last row, I set down: So that by this Addition, the whole Debt is found to be *Thirteen thousand nine hundred ninety five Pounds.*

A oweth	3564
B	5132
C	3156
D	1843
	13995

Characters used in Arithmetic.

Examp. 2. Suppose I have several Creditors to whom I owe several sums of Money, I desire to know the whole.

Therefore begin again (as always in *Addition*) at the right hand, I say, 11 and 10 is 21, and 4 is 25, and 6 is 31; now considering how many Shillings there are in 31 *d.* I find 2 *s.* and 7 *d.* wherefore I set down the odd 7 *d.* under the row of Pence, and carry the 2 *s.* to the next row, being Shillings, saying, 2 and 4 is 6, and 8 is 14, and 9 is 23, and 11 is 34; that is 1 *l.* 14 *s.* set down 14 *s.* and carry the 1 *l.* to the next row, saying 1 and 3 is 4 and 6 is 10, and 5 is 15, and 3 is 18: set down 8 and carry 1: then 1 and 3 is 4, and 5 is 9, and 3 is 12; 228 14 07 set down 2 and carry 1: Lastly, 1 and 1 is 2: so that by this Addition the whole Debt is, *Two hundred twenty eight Pounds, fourteen Shillings, and seven Pence.*

l.	Pounds.
s.	Shillings.
d.	Pence.
°	Degrees.
'	Minutes.
''	Seconds.

Example 3. Suppose at Sea, keeping my Reckoning in Degrees and Minutes, having six Days Difference of Longitude, I would know how much the whole is.

Say, 13 and 2 is 15, and 9 is 24, and 56 is 80, and 6 is 86; now 60 Minutes making a Degree, set down the odd 26 min. under the row of Minutes, and carry the 1 deg. to the next row, being Degrees; saying, 1 that I carry and 1 is 2, and 1 is 3, and 2 is 5, and 1 is 6, and 1 is 7. So that the whole Difference of Longitude made these six Days, is 7 Degrees and 26 Minutes.

1 Day,	1	°	06
2	—	0	56
3	—	1	09
4	—	2	00
5	—	1	02
6	—	1	13
	7	26	

Subtraction

Subtraction.

7

Subtraction is the taking of a less Sum out of a greater, subscribing the Remainder.

Example. Suppose a Man owed me ————— $\begin{matrix} l. & s. & d. \\ 376 & 13 & 06 \end{matrix}$
And hath paid me ————— $\begin{matrix} 211 & 05 & 08 \end{matrix}$
I desire to know what remains unpaid, which is ————— $\begin{matrix} 165 & 07 & 10 \end{matrix}$

To work this, I say, 8 from 6 I cannot, but considering there is 12 Pence contained in a Shilling, I add 12 to 6, and say 8 from 18, and there remains 10, which set down under the Pence; and then having borrowed 1, I go to the next row, and say, 1 that I borrowed and 5 is 6, which taken out of 13, there remains 7: then proceeding to the Pounds, I say, 1 from 6 there remains 5, and 1 from 7 there remains 6; and lastly, 2 from 3 there remains 1: So there remains due of the said Debt, *One hundred sixty five Pounds, seven Shillings, ten Pence.*

Ex. 2. Suppose the Distance between two Places to be 1000 Miles, and that I have sailed 396, and desire to know how many Miles I have to sail.

Therefore placing 396 under the 1000, I say 6 from 0 I cannot, but 6 from 10, there remains 4: proceeding to the next Figure, I say, 1 that I borrowed and 9 is 10; from 0 I cannot, but 10 from 10, there remains 0: Again, 1 that I borrowed and 3 is 4; from 0 I cannot, but 4 from 10, there remains 6: Lastly, 1 that I borrowed from 1, there remains 0, So there remains 604 Miles.

Example 3. Suppose one Place in the Latitude of 51 deg. 32 min. and another in the Latitude of 42 deg. 10 min. I would know the Difference of Latitude between them.

To do which, subtract the less Latitude out of the greater; thus; the lesser being placed undermost, say, 10 from 32, there remains 22, which place under the Minutes; then for the Degrees, 2 from 51 I cannot, but 2 from 11 there remains 9: then 1 that I borrowed and 4 is 5, 5 from 5 there remains 0. So the Difference of Latitude is 9 deg. 22 min.

Multiplication.

Multiplication is that which serves instead of many Additions, by which any Number of a greater Denomination is brought into a less, as Pounds into Shillings, and Shillings into Pence, and Pence into Farthings, Degrees into Minutes, Minutes into Seconds, and the like; which is done by multiplying the Number of the greater Denomination, by the Number of the lesser which is contained in the greater, as the multiplying any Number of Pounds by 20 (the Number of Shillings contained in a Pound) brings it into Shillings, and so of the rest.

Multiplication consists of three parts.

1. The Multiplicand, or Number to be multiplied.
2. The Multiplier, or Number by which to multiply,
3. The Product made by the Multiplication.

For the Learner's more ready Procedure herein, it is necessary to insert the Table, which is first to committed to Memory.

The

Multiplication.

The Multiplication Table.

2 times	2	4	4 times.	4	16	7 times	7	49
	3	6		5	20		8	56
	4	8		6	24		9	63
	5	10		7	28	8 times	8	64
	6	12		8	32		9	72
	7	14		9	36			
	8	16	5 times.	5	25	9 times	9	81
	9	18		6	30			
				7	35			
3 times	3	9	6 times	8	40	10 times	10	100
	4	12		9	45			
	5	15						
	6	18	is	6	36	is		
	7	21		7	42			
	8	24		8	48			
	9	27	is	9	54			

Examp. 1. I demand how many Shillings there is in 5648 *l.*

To answer this, multiply the given Number of Pounds by 20, thus; The first being a Cypher, set down 0 underneath the first Figure; then proceed to the next Figure, and say, 2 times 8 is 16; set down 6 under the second Figure and carry 1; then 2 times 4 is 8, and 1 that I carried makes 9; then 2 times 6 is 12, set down 2, and carry 1; Lastly, 2 times 5 is 10, and 1 that I carried makes 11. So that 5648 *l.* multiplied by 20, makes 112960 Shillings.

Example 2. In 276 Degrees, how many Minutes?

First set down 276

Then multiply by 60

Became 60 minutes make a Degree.

16560

So that I find 276 Degrees multiplied by 60, make 16560 Minutes.

Examp. 3. Multiply 8765437

Multiply 47632867

By 32

By 4352

17530874

26296311

95265734

238164335

142898601

190531468

Product

280493984

207298237184

Division.

Division is that which serves in the room of many *Subtractions*, and is useful in reducing all Numbers of a lesser Denomination into a greater, as Minutes into Degrees, Farthings into Pence, Pence into Shillings, and Shillings into Pounds. It consists of three parts, (*viz.*) *Dividend*, or the Num-

Division.

9

Number to be divided ; Divisor, or the Number to divide by ; and the Quotient, with the Remainder after Division,

Ex. 1. To divide 7834 by 23 ; first say, How many times 2 in 7 ? Or how often 23 in 78 ? the Answer will be 3 times, which place in the Quotient ; then multiply the Divisor 23 by 3, the Figure placed in the Quotient, saying, 3 times 3 is 9, and 3 times 2 is 6. and place these under the two first Figures

$$\begin{array}{r}
 \text{Divisor.} \quad \text{Dividend.} \quad \text{Quotient.} \\
 23 \overline{) 7834} \quad 340 \\
 \underline{69} \\
 93 \\
 \underline{92} \\
 14 \text{ Remains.}
 \end{array}$$

of the Dividend, and draw a Line ; subtract 69 from 78, and there rests 9, which set underneath, and place a Point under 3, to shew that it is brought down ; place it to the 9, then proceed, saying, how many times 23 in 93 ; or how many times 2 in 9 ? which will be 4 times ; place 4 in the Quotient, by which multiply the Divisor ; again, placing the Product, which is 92, under 93, and draw a Line, and subtracting it therefrom, the Remainder 1 put under the Line, and set down 4 the last Figure in the Dividend, putting a Point under it, and place it to the remaining 1 : Then because there remains but 14, being less than the Divisor 23, and so cannot be taken out of it, place a Cypher in the Quotient, and the Work is finished.

Ex. 2. In 360 Minutes, how many Degrees? Here I divide by 60, because 60 Minutes make a Degree ; and because 6 cannot be taken out of 3, therefore I say, How many times 6 in 36 ?

$$\begin{array}{r}
 \text{Divisor.} \quad \text{Dividend.} \quad \text{Quotient.} \\
 60 \overline{) 360} \quad 6 \\
 \underline{360} \\
 00
 \end{array}$$

The Answer is 6 times : which I place in the Quotient, and proceed to multiply the Divisor by the 6 placed in the Quotient, which produceth 360 ; which subtracted leaves 0. So that by this Work, it appears that in 360 Minutes there are 6 Degrees just.

Examp. 3. A Ship taken by 253 Men, is valued at 59875 l. I demand each Man's share, being equally divided.

$$\begin{array}{r}
 \text{Divisor.} \quad \text{Dividend.} \quad \text{Quotient.} \\
 253 \overline{) 59875} \quad 236 \\
 \underline{506} \\
 927 \\
 \underline{759} \\
 1685 \\
 \underline{1518} \\
 167 \text{ Remains.}
 \end{array}$$

Proof. 59875

First, say, How many times 2 in 5 ? The Answer is two times, which place in the Quotient ; then multiply the Divisor 253 by 2, the Figure placed in the Quotient, saying, 2 times 3 is 6, 2 times 5 is 10, set down 0, and carry 1 ; 2 times 2 is 4, and 1 is 5 ; which set down under the three first Figures of the Dividend, from whence being subtracted, set the Remainder underneath, which will be 62 ; then take down 7, making a Point underneath.

B

nearh, and set it after 92 the Remainder; then say how often 2 in 9? Answer, 3 times, (for 4 will prove to many.) Then multiply the Divisor 253, as before, by 3, the Figure last placed in the Quotient, and the Product will be 759, which being subtracted from the Figures above, the Remainder will be 168; then take down 5, and point it as before, setting it after 168, the last Remainder; and again ask the Question, how often 2 is contained in 16? Answer, 6 times; by which 6, when set in the Quotient, multiply the Divisor 253; and the Product is 1518, which place under the last Dividend, and subtracted therefrom, there will remain 167. So there being no more Figures to bring down, the Work is finished, each Man's share being 236l. and 167l. over, which is to be divided among them; which may easily be done by multiplying 167 by 240, and dividing the Product by 253, gives each Man's share in Pence. The Proof is by multiplying 253 the Divisor, by 236 the Quotient; and taking in 167 the Remainder, the Product will make the same with the Dividend, as it is wrought above.

The Rule of Three.

The Rule of Three, is that, which having three Numbers given, a fourth Number is found in Proportion thereunto: which is done by multiplying the 2d and 3d Numbers together, and dividing the Product by the first, and the Quotient of the said Division is the Answer to the Question.

Examp. 1. If in 24 hours a Ship sails 130 Miles: How many Miles will she sail with the same Gale in 192 Hours, or eight Days?

$$\begin{array}{r}
 192 \\
 130 \\
 \hline
 5760 \\
 192 \\
 \hline
 24 \overline{) 24960} (1040 \text{ Miles in 192 Hours.} \\
 24 \cdot \cdot \cdot \\
 \hline
 96 \\
 96 \\
 \hline
 00
 \end{array}$$

Here 24 is the first Number, 130 the second, and 192 the third; wherefore, according to the Rule, I multiply 130 and 192 the second and third Numbers together, and divide the Product thereof 24960, by 24 the first Number, which gives in the Quotient 1040 Miles, which is the way the Ship will make in 192 Hours the time proposed.

Example 2. If 1 lb of Tobacco cost 6d, what 112 lb cost?

$$\begin{array}{r}
 112 \\
 6 \\
 \hline
 \end{array}$$

1) 672 Pence (or 56 Shillings.

Here the first Number being an Unit, which neither multiplies nor divides, it saves the labour of Division, and the Answer is 672 d. (for the Answer will be of the same name with the second Number) which divided by 12, to bring them into Shillings, gives in the Quotient 56 s. which is the price of 112 lb. as was required.

The Rule of Three.

11

Example 3. If a Staff of 2 Yards long give a shadow of 3 Yards; How high is that Castle whose shadow is a 100 Foot?

Which Question for the more ready Solution, state thus:

If 6 Foot (which is 2 Yards) give 9 Foot, what shall 100 Foot give?

By the Operation it appears the said Castle must be 150 Foot high.

$$\begin{array}{r}
 9 \\
 \hline
 6 \overline{) 900} (150 \text{ Foot} \\
 \underline{600} \\
 300 \\
 \underline{300} \\
 00
 \end{array}$$

Example 4. If 564 l. 12 s. 6 d. is to be divided between 165 Men, how much is one Man's Share? State it thus:

If 165 Men have 564 l. 12 s. 6 d. What shall 1 Man have?

$$\begin{array}{r}
 20 \\
 \hline
 11292 \\
 \hline
 12 \\
 \hline
 22590 \\
 11292 \\
 \hline
 165 \overline{) 135510} (821 \text{ Pence.} \\
 \underline{13200} \\
 351 \\
 \underline{330} \\
 210 \\
 \underline{165} \\
 45
 \end{array}$$

$$\begin{array}{r}
 12 \overline{) 821} (68 \text{ Shillings.} \\
 \underline{720} \\
 101 \\
 \underline{96} \\
 5 \text{ Pence.}
 \end{array}$$

Note; That in the *Rule of Three*, the first and third Numbers must be both of one denomination, and the second must be brought into the lowest value expressed therein, as in the foregoing Example. I work not the Question as it was first stated, but transporting the Numbers, I put the denomination of Men first and last, and the Money in the midst, to answer to that part of the Rule which requires the first and third Numbers to be both of one name. Again, because in the second Number, Pence are expressed, I therefore bring the whole Sum into Pence, which answers to the other part of the Rule, which requires the second Number into the lowest value. The Answer therefore to the preceding Question, as by the Operation appears, is 821 Pence; which reduced into Shillings, is 68 s. and 5 d. or 3 l. 8 s. and 5 d. which is one Man's share, as was required.

The next thing I shall briefly treat of, is *The Extraction of the Square and Cube Roots*, as also somewhat of their Use

The Extraction of the Square Root.

Example 1. TO extract the Square Root of 7056, proceed thus: First, point the given Number (that is, put a Prick) over every other Figure beginning at the first Figure on the right hand (and note by the way, that so many Points as the said Number

$$\begin{array}{r}
 \text{Root} \\
 7056 (84 \\
 \underline{64} \\
 164 \overline{) 656} \text{ Div.} \\
 \underline{656} \\
 000
 \end{array}$$

The Extraction of the Square Root.

mits over it, of so many Figures consists the Root of the said Number) then proceed, seeking the greatest Square Number (which is a Number multiplied by it self) in the first Point towards the left hand (70) which is 64 constituted of 8 multiplied into it self; for 8 times 8 is 64. The Root of the Square Number, which is 8, place in the Quotient, and subscribe the Square Number (64) under the said first Point, subtracting it therefrom, and setting down the Remainder (6) underneath: To this Remainder bring down the next Point (56) then drawing a crooked Line on the Left-hand of the Dividend (656) double the Quotient, and place it (*viz.* 16.) therein, calling it the Divisor; seek how often this Divisor is contained in all the Figures of the Dividend, save the last to the right hand (*viz.*) How many times 16 in 65? The Answer is 4 times, which place in the Quotient, and also on the Right-hand of the Divisor (16) then multiply the Divisor (164) by the 4 placed last in the Quotient, and put the Product, which is 656, under the Dividend, subtracting it therefrom; which done, nothing remains. So that the Square Root of 7056 is 84.

The Square Root is applied to Navigation as follows.

Any two sides of a Right-angled Plain Triangle being given, the third is found by the Extraction of the Square Root.

Ex. 2. Suppose a Ship to have made 87 Miles Difference of Latitude, and 71 Miles Departure, and the Distance to be required; the said Distance is found by the Extraction of the Square Root, as follows.

The Rule. Square the Difference of Latitude and Departure severally (that is, multiply each by it self) and from the Sum of both their Squares added together, extract the Square Root, which will be the Distance required.

Example 1.

Difference of Lat. is 87	The Departure 71.	Square Diff. Lat. 7569
Multiplied by it self 87	Multip. by it self 71.	Square Depart. 5041
609	71	Sum 12610
696	497	
The Square.—7569	The Square—5041	

By this Operation it appears, that the Distance, omitting the Fraction, is 112 Miles.

$$\begin{array}{r}
 12610 \text{ (112, the Distance required.)} \\
 \underline{1} \\
 21 \) \ 026 \\
 \underline{21} \\
 222 \) \ 510 \\
 \underline{444} \\
 66
 \end{array}$$

Ex. 2. Suppose a Ship's Distance to be 111 Miles, and her Departure 57 Miles, and the Difference of Latitude to be required; the said Difference of Latitude is found by the Extraction of the Square Root, as follows.

The Rule. From the Square of the Distance subtract the Square of the Departure, and the Square Root of the Remainder will be the Difference of Latitude required.

Example.

The Extraction of the Square Root.

13

<i>Example</i> The Distance	111	The Departure	57
Multiplied by it self	111	Multipl. by it self	37
	111		399
	111		285
	111	Sq. of Depart.	3249
Square of the Distance	12321		
Square of the Depart, subtract	3249	9072 (95 Diff. Lat. required.	
		81	
Remains	9072		
	185	972	
		925	

The Difference of Latitude, as by the Operation appears, is 95 Miles, omitting Fractions.

If the Departure be required, the Rule is this, *viz.* From the Square of the Distance subtract the Square of the Difference of Latitude, and the Square Root of the Remainder is the Departure required: The Operation for brevity sake is omitted.

Having proceeded thus far in shewing the Practitioner how to find the Distance, Difference of Latitude and Departure (any two of them being given) without Trigonometry, I shall shew the manner of finding the Course (exact enough for common use) without the said Operation, which is done as follows.

The Proportion to find the Course. As the Sum of the Hypotenuse (or Distance) and half the greater of the other two Legs (*viz.*) if the Difference of Latitude be most, half that; but if the Departure be most, half that;) I say, as the Sum of these two is in proportion to the lesser (or remaining) Leg, so is 86 to the Angle (in Degrees) opposite to the less Leg; which is the Course, when the Departure is less than the Difference of Latitude, otherwise 'tis the Complement of the Course.

Example Admit a Ship's Distance to be 110, the Difference of Latitude to be 88, and the Departure 66, and the Course required.

First Add the Distance, and half the greater Leg, into one Sum.

The Distance is	110
Half the greater Leg (88) is	44
The Sum	154

Having thus done, say by the Rule of Three:

As the said Sum 154 to 66 the lesser Leg, so is 86 to the Course.

To bring out the odd Minutes, multiply the Remainder of the Division 132 by 60, (the Number of Minutes contained in a Degree) and divide the Product by the Divisor (154,) and the Quotient of the said Division gives for the answer 51 Minutes. So that the Course required is 36 deg. 51 min.

	66
	516
	516
154	5676 (36 deg. 51 min.
	462
	1056
	924
	132

Example.

The Extraction of the Square Root.

Example 3. Extraction of the Square Root. Suppose a Rope of 5 Inches compass, and another Rope of double the strength, is desired. The Dimensions of the said required Rope are found by the Extraction of the Square Root: For should it be supposed that a Rope of 10 inches compass, is but double the strength of a Rope of 5 inches; upon proof it is manifestly false, for the said Rope of 10 inches is four times of the strength of that of 5.

The Rule. Take the compass of the given Rope (*viz.* 5) and multiply that by it self; which Product (because the other Rope is to be twice as strong) multiply by 2, and the Square Root of the Product is the compass of the Rope required.

Example The given Rope's compass 5 Inches. Extract the Root 50 (7 Multiplied by it self

5	49
The Square	25
Multiplied by	2

So that by the Operation it appears, a Rope to be twice the strength of the given Rope of 5 inches compass, must be 7 inches.

If it's desired to know the weight of one Rope by another, 'tis as follows:

The Proportion is; as the Square of the Compass of the one Rope, is to the Square of the Compass of the other; so is the weight of the one to the weight of the other, length for length.

Example, Suppose a Cable of 10 inches to weigh 21 hundred, and the weight of a Cable of 8 inches required. Say,

As 100 (the Square of 10) to 64 (the Square of 8) so is 21 C. the weight of one Cable, to 13 C. $\frac{44}{100}$ parts, the weight of the other Cable required.

Extraction of the Cube Root.

I Shall first, as necessary, insert a Table of the Cubes of the Nine Digits, which ought to be committed to memory.

Cubes of the Nine Digits.	$\left\{ \begin{array}{l} 1-001 \\ 2-008 \\ 3-027 \end{array} \right\}$	$\left\{ \begin{array}{l} 4-064 \\ 5-125 \\ 6-216 \end{array} \right\}$	$\left\{ \begin{array}{l} 7-343 \\ 8-512 \\ 9-729 \end{array} \right\}$
---------------------------	---	---	---

Example 1. Extract the Cube Root of 12167

First, Point the given Number, (*i. e.*) put a prick over every third Figure; then seek the greatest Cube in the first point (*viz.* 12.) which is 8, the Cube Root whereof (which is 2) place in the Quotient; subtract the Cube (8) from the first point (12) place the Remainder underneath; to this Remainder bring down the next point (167) and call this the Resolvend; then draw a Line underneath it, then square the Quotient (2) which is 4, multiply the said square (4) by 300, which makes 1200; place this under the Resolvend, and call it the Triple Square. Again, mul-

12167 (23 Root.

8

4167 Resolvend.

1200 Triple Square.

60 Triple Quotient

1260 Divisor.

3600

540

27

4167

0000

0000

0000

0000

0000

0000

0000

Extraction of the Cube Root

15

riple the Quotient (2) by 30, which makes 60; place this under the Triple Square, and call it Triple the Quotient; add these two (*viz.* Triple Square and Triple Quotient) into one Sum, and call it the *Divisor*; seek how often this *Divisor* is contained in the Resolvend, which is three times; which three place in the Quotient; multiply the Triple Square by the 3 last placed in the Quotient, and Subscribe the Product underneath the *Divisor*; square the said Figure (3) last placed in the Quotient, and thereby multiply the Triple Quotient, and place it underneath the last Product; Cube the Figure (3) last placed in the Quotient, and place it underneath the preceding Products. Lastly, add these 3 Products into one Sum, and subtracting the said Sum from the Resolvend, subscribe the Remainder; to which Remainder, had there been any more Figures, the next Point must have been brought down, and the preceding Work reiterated from the squaring of the Quotient, until all the Figures are so brought down; but in this Example, there being no more Figures, the Work is done, and by the Operation the Cube Root of 12167 appears to be 23 just; nothing remaining.

Examp. 2. applied. Suppose a Ship of 300 Tun, 75 foot by the Keel, 29 foot and a half at the Beam, and 14 foot deep in the Hold; and another the Ship is desired of the same Mould and Shape of 500 Tun: The several Dimensions of the Ship are found by the Extraction of the Cube Root.

Examp. Beginning with the Keel: First, Cube the length of the given Keel, which is done by multiplying it into it self, and then multiplying the Product by it again.

Then say by the Rule of Three; As 300 Tun the one Ship's Burthen, to 500 Tun the other Ship's Burthen; so is 421875 the Cube of the one Ship's Keel's length, to the Cube of the other Keel's length. Which being wrought by the Rule of Three, gives 703125: From which extract the Cube Root, and that will be the length of the Keel required.

In this Extraction 3 Cyphers are added to bring out the Fraction, the Operation therewith being the same as if there had been more Figures in the proposed Number; the Operation gives for the length of the Keel required 88 foot $\frac{2}{10}$ parts.

Thus; having found one of the dimensions, the rest may be found, without the Extraction of the Root, by the Rule of Three.

Thus; suppose the next thing I would find,

75 given Keel.

75

375

525

5625

75

28125

39375

421875 Cube given Keel.

703125

512

88 $\frac{2}{10}$ Root.

191125

Resolvend.

19200

Tripple Square.

240

Triple Quotient.

19440

Divisor.

153600

15360

512

169472

21653000

Resolvent.

2323100

T. S.

2640

T. Q.

2325840

Divisor

20908800

213840

729

21123369

529631

Remainder.

The Extraction of the Cube Root.

to be her breadth by the Beam, say; As the length of the one Ships Keel 75, is to the length of the other 89 *feet*; So is 29 $\frac{1}{2}$ Foot, the breadth of the one Ship by the Beam, to the breadth of the other; which by the Rule of Three, gives 35 Foot $\frac{1}{4}$. So you may find the depth in Hold, &c.

Example 3. Suppose an Iron Shot 4 Inches Diameter, to weigh 9 lb , and the Diameter of a Shot whose weight is 72 lb required. This also is done by the Extraction of the Cube Root as follows:

First. say by the Rule of Three;

As 9 lb , the weight of one Shot, to 72 lb , the weight of the other; to is 64 the Cube of the one Shot's Diameter, to the Cube of the other Shot's Diameter: which by the Operation is 512, the Cube Root of which is 8 the Diameter of the Shot required,

But if it were required to find the weight of a Shot by the Diameter, it's done thus, by the Rule of Three.

As the Cube of the one Shot's Diameter, to the Cube of the other;

So is the weight of the one Shot, to the weight of the other required.

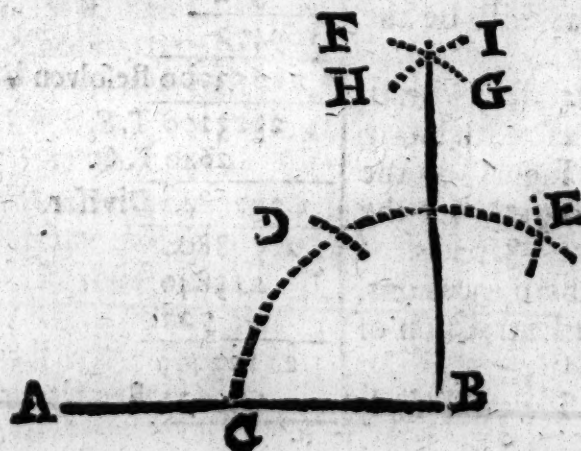
And thus much for the Arithmetical Part of this Treatise.

Some necessary Geometrical Problems.

Problem I. To raise a Perpendicular on the middle of a Line.



Let the Line given be A B, and the Perpendicular to be raised from the Point C: to do which, set off the two equal Distances, CA and CB: Then the Compasses being opened to any convenient Distance bigger than A C or C B, with one foot of the Compasses in the Point A, describe the Arch D E; then with one foot in the Point B describe the Arch F G, then draw the Perpendicular from the Point C through the Intersection (or Cutting) of the two Arches FG and DE, which was required.



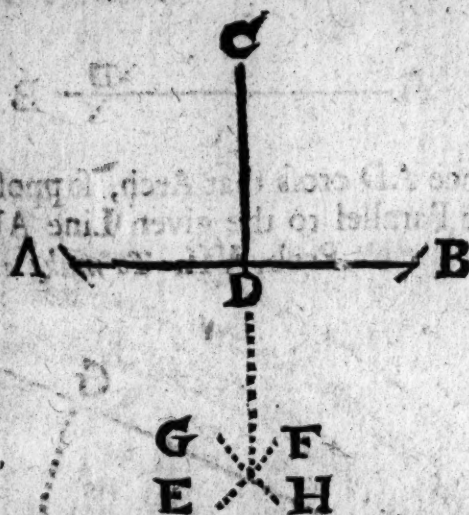
Prob. II. To raise a Perpendicular on the end of a Line.

Let the Line given be A B, the Perpendicular to be raised from the Point B: to do which, with one foot of the Compasses at B, with any convenient distance, as BC, sweep an Arch; then with the same extent, one Foot of the Compasses being in the Point C, mark the said Arch at the Point D, and one Foot being at D, mark it at E; then

then with the same Distance, one Foot of the Compasses being in the point D, describe the Arch FG; and placing the Compasses in the point E, describe the Arch HI; then from the point B, and through the Intersection of the two Arches FG and HI, draw the Perpendicular which was required.

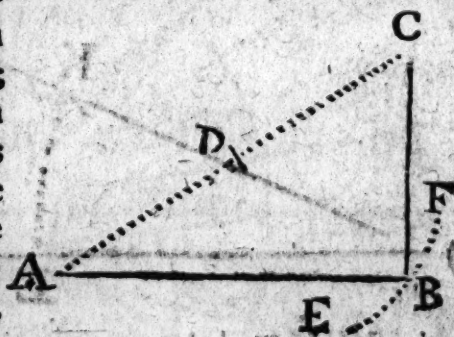
Prob. III. *To let fall a Perpendicular from a Point assigned over the middle of a Line.*

Let A B be the Line given, C the point over the Line, from which the Perpendicular is to fall; to do which, place one foot of the Compasses in the point C, then opening them to a convenient distance, mark the Line AB in two points with the said distance, as in the points A and B; then with one foot of the Compasses in the point A, describe the Arch EF, and with one foot in the Point B, describe the Arch GH; then from the point C, and by the Intersection of the said two Arches, draw the Perpendicular which was required.



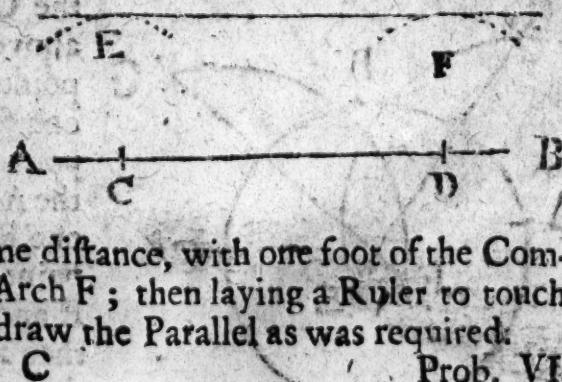
Prob. IV. *To let fall a Perpendicular from a Point given over the end of a Line.*

Let the Line given be A B, upon the end of which let it be required to let fall a Perpendicular from the Point C; to do which from the point assigned C, draw the Line CA; which Line divided into 2 equal parts, as in the point D, then one point of the Compasses resting in the point D, with the same distance (*viz.* of half the Line A C) describe the Arch EF; then from the point C, to the Intersection of the Arch EF with the Line AB, draw the Perpendicular as was required.



Prob. V. *To draw a Line Parallel to a Line given.*

Let AB be a Line given, to which is required to draw a Line parallel; to do which, first take in the Compasses the distance at which the parallel Line is to be drawn, and then setting one foot of the Compasses in the point C, on the Line AB describe the Arch E; and with the same distance, with one foot of the Compasses in the point D, describe the Arch F; then laying a Ruler to touch the Convexity of the two Arches, draw the Parallel as was required.



Prob. VI.

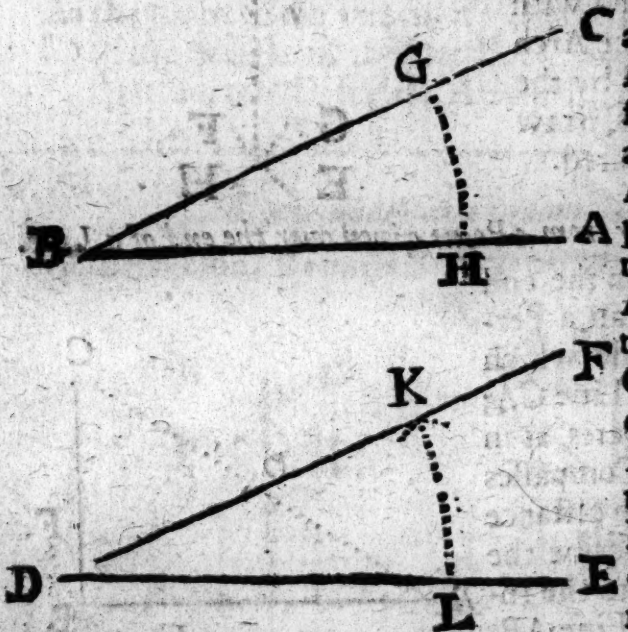
Prob. VI. To draw a Right-line Parallel to a given one, that shall pass through a Point given.

Suppose AB the given Line, and it is required to draw a Line Parallel thereto, that shall pass through a given Point as C.



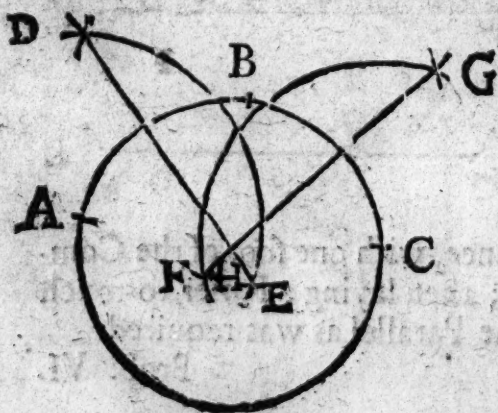
Set one foot of the Compasses on C, with the other, at any Distance, cross AB in D; and with that Distance, from any Point, as A, of the Line AB, describe an Arch EF; then from C, with the Distance AD cross that Arch, suppose in G; the Line CG being drawn, shall be Parallel to the given Line AB, as required.

Prob. VII. To make an Angle equal to any given Angle.



Suppose ABC an Angle given, and it is required to make another Angle equal thereto: To do this, first draw the Line DE, then with any Convenient distance less than AB, describe the Arch GH; then placing the Compasses at D, with the same distance which swept the Arch GH, sweep the Arch KL; then take the Length of the Arch GH in the Compasses, and setting one foot in the point L, cross the Arch LK in the point K, then through the point K draw the Line DK; then is the Angle EDF, equal to the Angle ABC, as was required.

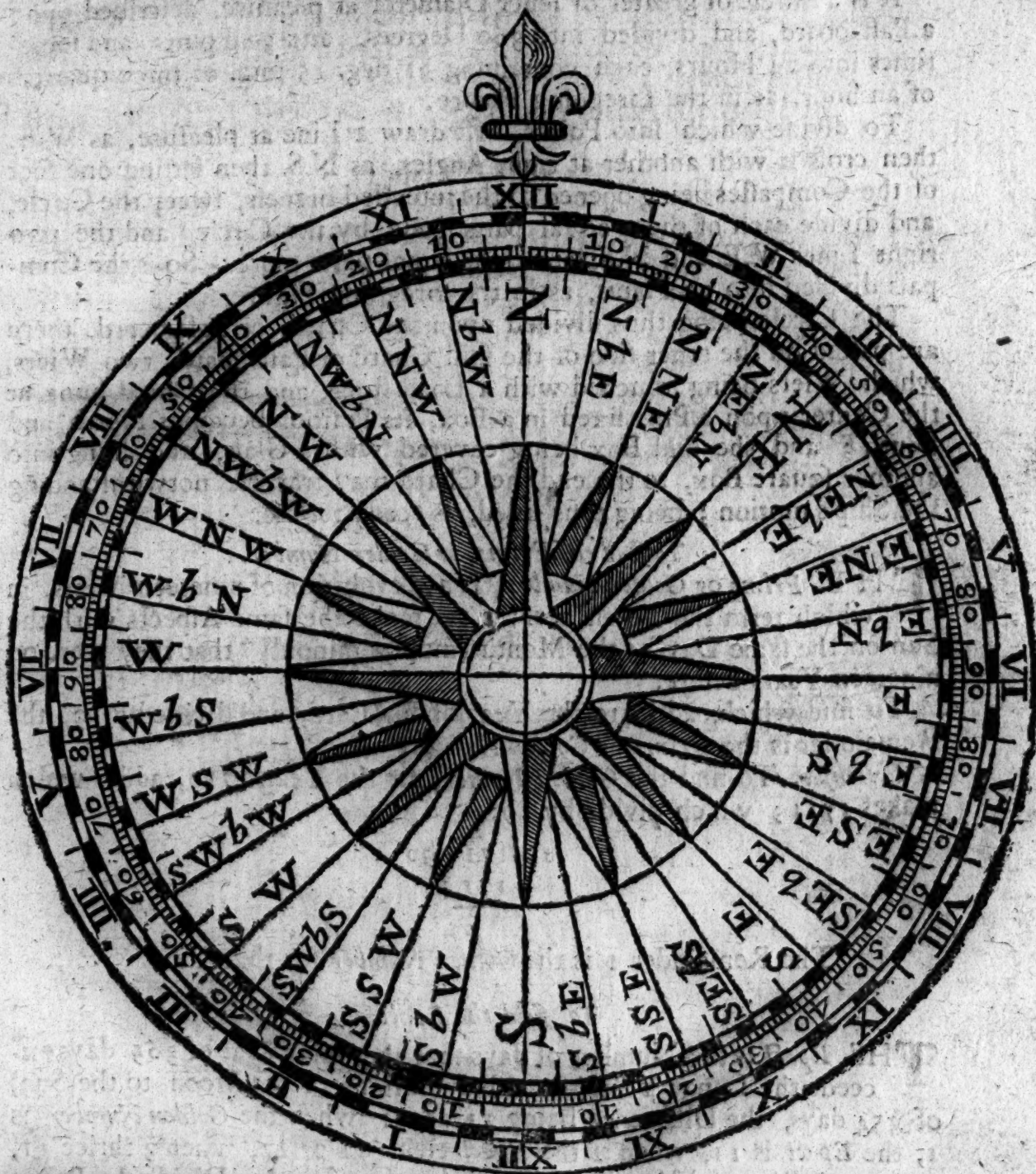
Prob. VIII. To bring any three Points, not situated in a right Line, into the Circumference of a Circle.



Let the three Points through which the Circle is to pass, be A, B, C: Take above half the Distance between the two points A and B in the Compasses; and one foot of the Compasses being in the point A, with the same distance describe the Arch ED, and with the same distance, one foot of the Compasses being in the point B, mark the Arch ED in the points E and D, and draw the right Line ED; then take above half the distance between the points C and B in the Compasses, and one foot of the Compasses, being in the point

point C, with the said distance describe the Arch FG; and with the same distance, one foot of the Compasses being in the point B, mark the Arch FG in the points F and G, and draw the right Line FG. Now where the two right Lines DE and FG, being continued, intersect each other, (*viz.* in the point H) is the Center of a Circle, which was required.

The Figure of the Mariners Compass.



THIS Instrūment, so beneficially assistant to the practical Part of Navigation, as to its Inventor, is uncertainly discoursed of; it's Age, by some

some supposed to be in these parts of the World, about 300 Years; the Utility whereof to us evidently appears, considering the many Inconveniences that attended our Ancestors, in tracing the vast Ocean, for want of such a Guide, under whose subordinate Conduct of later Years, our Maritime Affairs have succeeded so well.

The Description of the Compass.

It is a Circle of greater or lesser Diameter at pleasure, described upon a Past-board, and divided into 360 Degrees, and 32 Points, and sometimes into 24 Hours, each containing 11 deg. 15 min. or three quarters of an hour, as in the foregoing Figure.

To divide which into Points, first draw a Line at pleasure, as W.E. then cross it with another at right Angles, as N.S. then setting one foot of the Compasses being opened to the intended bigness, sweep the Circle, and divide each of the 4 equal parts made by the Circle and the two right Lines W.E. and N.S. into eight equal parts more. So is the Compass divided into 32 Points, as in the foregoing Figure.

The Circle being thus divided upon the Chard, or Past-board, there are pasted on the other side of the said Chard or Past-board, two Wiers, which Wiers being touched with a Load-stone, and the Chard hung at the Center upon a Pin, fixed in a Box, its Position becomes North and South; and the said Box being covered with a Glals, and hung into another square Box, to the end the Chard may traverse notwithstanding the Ship's motion; being thus fixed, is ready for use.

To find the Prime, or Golden Number.

THE Prime or Golden Number, is a Revolution of nineteen Years, in which term the Moon returns to make the same Aspects with the Sun on the same Day of the Month (most commonly) that they were on nineteen Years before.

To find which, add 1 to the Year of our Lord, and divide by 19, the Remainder is the Prime or Golden Number.

Example. To find the Golden Number for the Year 1710, add 1 which makes 1711; which divide by 19.

$$19 \overline{) 1711} 90$$

$$171$$

$$01$$

The Remainder 1 is the Golden Number for that Year.

To find the Epact.

THE Epact is the Number of days that the Solar Year of 365 day exceeds the Lunar Year (or 12 Revolutions of the Moon to the Sun) of 354 days, the Difference being 11 days: when the Golden Number is 1, the Epact is 11, when 2 the Epact twice 11 or 22, when 3 thrice 11, or 33 rejecting 30) that is 3, &c. and is thus found: Divide the Prime by

To find the Moon's Age.

21

3 ; if 0 remain, the Epact is the same with the Prime, if 1 remain, add 10 ; if 2 add 20 to the Prime ; the Sum (rejecting 30, if need be) is the Epact.

Examples.

In the Year 1708, the Golden Number is 18 ; which divided by 3, there remains 0, therefore the Epact is 18.

In the Year 1713, the Golden Number is 4 ; which divided by 3, there remains 1 ; for which 10 added to the Golden Number 4 makes the Epact 14.

In the Year 1717, the Golden Number is 8 ; which divided by 3, there remains 2 ; therefore 20 added to 8, makes the Epact 28.

To find the Moon's Age.

ADD to the Epact for March 1 for April 2, for May 3, for June 4, for July 5, for August 6, for September 8, for October 8, for November 10, for December 10, for January 0, for February 2.

Having added to the Epact the Number for the Month, according to the Rule foregoing, add thereto the day of the Month, for which the Moon's Age is required : these three Sums added together, if less than 30, is the Moon's Age ; if more than 30, take 30 from it as often as may be, the Remainder is the Age of the Moon. The Moon's Age subtracted from 30, leaves the day of the Change. Again 15 added to, or subtracted from the day of Change, leaves the day of Full Moon.

Example.

Suppose it were required to find the Moon's Age for the fifth day of September 1715.

First set down the Epact for that Year ————— 06

To which add the Number for the Month, which is ——— 08

To which add the day of the Month, which is ——— 05

The Moon is 19 days old.

Then out of 30

Take ——— 19 The Moon's Age.

Remains ——— 11 Days to the Change.

Add ——— 15

Makes ——— 26 Days to Full Moon.

To find the Dominical Letter.

TAKE the Year and its fourth part, and add 4 to it ; then divide the Sum by 7, and subtract what remains from 7, the Remainder shews the thing required ; accounting the Letter A for 1, B for 2, C for 3, D for 4, E for 5, F for 6, G for 7.

Suppose

To find the Cycle of the Sun.

Suppose the Dominical Letter were required for the Year 1716

First, set down the Year 1716

Then the 4th part, which ommitting Fraction, is 429

To which add 4

2149

The Sum divide by 7 $2149 \div 7 = 307$ 21

The Remainder after Division is 0, which being subtracted from 7, leaves 0; which shews it must be the seventh Letter, which is **G** the Dominical Letter for 1716 required. But being Leap-year, there are two Dominical Letters, A and G; A serving from the beginning of the Year to the last of *February*, G all the Year after.

049

49

00

To find the Cycle of the Sun.

ADD to the Year 9, divide the Sum by 28, the Remainder is the Cycle of the Sun.

Suppose it be required for the Year 1710

Then add 9

Divide by 28 $1719 \div 28 = 61$ 168

39

28

11

By the Operation it appears that 11 is the Cycle of the Sun for the Year 1710, being the Remainder after division.

Note, *Hillary* Term begins Jan. 23, and ends Febr. 12.

Easter Term begins on Friday after *Trinity-Sunday*, and ends the Monday before *Whitsunday*.

Trinity Term begins on Friday after *Trinity-Sunday*, and ends 19 days after.

Michaelmas Term begins Octob. 23. and ends November 28.

A Table of the Dominical Letters, Cycle of the Sun, Prime, Epact, and Moveable Feasts, for 26 Years

Years.	Dom. Let.	Cycle O.	Prime.	Epact.	Shrove- Sunday.	Easter- Sunday.	Whit- Sunday.
1707	E	8	17	7	February 24	April 13	June 1
1708	D C	9	18	18	14	4	May 32
1709	B	10	19	29	March 6	24	June 12
1710	A	11	1	11	February 19	9	May 28
1711	G	12	2	22	11	1	20
1712	F E	13	3	3	March 2	20	June 8
1713	D	14	4	14	Febr. 15	5	May 24
1714	C B	15	5	25	7	March 28	16
1715	B	16	6	6	27	April 17	June 5
1716	A G	17	7	17	12	2	May 21
1717	F	18	8	28	March 3	21	June 9
1718	E	19	9	9	February 23	13	1
1719	D	20	10	20	8	March 29	May 17
1720	C B	21	11	1	28	April 17	June 5
1721	A	22	12	12	19	9	May 28
1722	G	23	13	23	4	March 25	13
1723	F	24	14	4	24	April 14	June 2
1724	E D	25	15	15	16	5	May 24
1725	C	26	16	26	February 7	March 28	16
1726	B	27	17	7	20	April 10	29
1727	A	28	18	18	12	2	21
1728	G F	1	19	29	March 4	21	June 9
1729	E	2	1	11	16	6	May 15
1730	D	3	2	22	8	March 29	17
1731	G	4	3	3	28	April 18	June 6
1732	B A	5	4	14	13	9	May 28

A Table

M. {		D.	H.	M.	M. {		D.	H.	M.
January.	New moon.	03	06	55	July.	First quart.	06	09	41
	First quart.	10	00	54		Full Moon.	14	03	39
	Full moon.	17	08	57		Last quart.	20	23	24
	Last quart.	25	13	00		New moon.	28	02	15
February.	New moon.	01	18	40	August.	First quart.	05	03	21
	First quart.	08	10	10		Full moon.	12	13	19
	Full moon.	16	02	24		Last quart.	19	05	18
	Last quart.	24	06	40		New moon.	26	16	07
March.	New moon.	03	04	32	September.	First quart.	03	22	27
	First quart.	09	20	47		Full moon.	10	22	19
	Full moon.	17	20	02		Last quart.	17	13	27
	Last quart.	25	20	21		New moon.	25	08	20
April.	New moon.	01	14	08	October.	First quart.	03	11	35
	First quart.	08	09	23		Full moon.	10	07	12
	Full moon.	16	12	43		Last quart.	17	00	47
	Last quart.	24	06	10		New moon.	25	02	23
	New moon.	30	21	01	November.	First quart.	02	00	38
May.	First quart.	08	00	00		Full moon.	08	16	47
	Full moon.	16	03	38		Last quart.	15	16	08
	Last quart.	23	13	08		New moon.	23	21	00
	New moon.	30	05	22	December.	First quart.	01	11	45
June.	First quart.	06	16	15		Full moon.	08	03	35
	Full moon.	14	16	35		Last quart.	15	11	09
	Last quart.	21	18	29		New moon.	23	14	44
	New moon.	28	14	52		First quart.	30	20	54

Four Eclipses this Year, two of each Luminary.

The first is of the Moon, April 16. Past Midnight, visible to us, and 6 Digits of her Body will be obscured on the South side. The 2d is of the Sun, May 1. at 9 in the Morning; it will be a very great *Deliquium*, and 1 Digit of that Glorious Light will be obscured from us, it will be visible to all *Europe*, *Asia*, and *Africa*. The 3d is of the Moon, Octob. 10. a little after 7 at Night; and if the Air be clear, the beginning may be seen soon after she rises, and will be near 7 Digits eclipsed on the North side. The Sun is eclips'd again, Octob. 25. past 2 in the Afternoon; but her Latitude and Parallax will make it invisible to us.

A Table of the Moon's Age for the Year 1707. 25

M.		D.	H.	M.		M.		D.	H.	M.
January.	Full moon.	06	16	00	July.	Full moon.	03	10	55	
	Last quart.	14	08	27		Last quart.	10	20	28	
	New moon.	22	06	22		New moon.	17	12	40	
	First quart.	30	05	07		First quart.	24	23	16	
February.	Full moon.	05	06	00	August.	First quart.	02	00	03	
	Last quart.	13	05	51		Last quart.	09	02	04	
	New moon.	20	19	23		New moon.	15	22	34	
	First quart.	28	12	43		First quart.	23	17	41	
March.	Full moon.	06	21	14	September.	Full moon.	31	11	51	
	Last quart.	15	01	10		Last quart.	07	07	2	
	New moon.	22	05	48		New moon.	14	11	10	
	First quart.	28	20	50		First quart.	22	12	44	
April.	Full moon.	05	13	13	October.	Full moon.	29	22	51	
	Last quart.	13	17	00		Last quart.	06	15	00	
	New moon.	21	14	11		New moon.	14	02	35	
	First quart.	27	06	14		First quart.	22	07	15	
May.	Full moon.	05	05	13	November.	Full moon.	29	09	07	
	Last quart.	13	05	00		Last quart.	05	00	35	
	New moon.	19	21	23		New moon.	12	02	34	
	First quart.	26	17	32		First quart.	20	23	51	
June.	Full moon.	03	01	37	December.	Full moon.	27	19	17	
	Last quart.	11	13	49		Last quart.	04	13	34	
	New moon.	18	04	34		New moon.	12	15	53	
	First quart.	25	08	07		First quart.	20	13	39	
						Full moon.	27	05	40	

Six Eclipses, four of the Sun, and two of the Moon.

1. Of the Sun, *March 22.* and where greatest can be but 4 Digits, and cannot be seen of us by reason of the Moon's South Latitude. 2. Of the Moon, *April 6.* at 1 Morning, visible, and a Central Eclipse, the beginning is at 11b. 15m. the middle at 13h. 12m. and the end at 15b. 10m. P.M. 3. Is of the Sun *April 21.* at 2 Morning invisible to us. 4. Of the Sun, *Sept. 14.* at 11 at Night, invisible. 5. Of the Moon, *Sept. 30.* about 11 *Mare*, invisible. The last is of the Sun, *Octob. 14.* 2b. 35m. P.M. but the Moon's Latitude and Parallax to us will depress her below the Sun's Limb, that it will not be visible to any part of *Europe*.

M.		D.	H.	M.	M.		D.	H.	M.
January.	Last quart.	03	01	16	July.	New moon.	05	04	24
	New moon.	11	10	50		First quart.	13	01	27
	First quart.	19	02	07		Full Moon.	21	03	56
	Full moon.	25	16	12		Last quart.	28	20	25
February.	Last quart.	02	02	03	August.	New moon.	04	11	32
	New moon.	10	04	08		First quart.	10	17	21
	First quart.	17	11	14		Full moon.	19	18	56
	Full moon.	24	02	25		Last quart.	27	05	14
March.	Last quart.	02	22	06	September.	New moon.	02	20	58
	New moon.	10	18	44		First quart.	10	08	11
	First quart.	17	15	58		Full moon.	18	09	12
	Full moon.	24	17	36		Last quart.	25	09	15
April.	Last quart.	01	18	05	October.	New moon.	20	08	29
	New moon.	09	05	53		First quart.	10	04	07
	First quart.	16	00	57		Full moon.	18	01	28
	Full moon.	23	07	20		Last quart.	24	18	03
May.	Last quart.	01	11	03	November.	New moon.	31	22	38
	New moon.	08	14	18		First quart.	09	01	04
	First quart.	15	06	10		Full moon.	16	10	16
	Full moon.	22	21	46		Last quart.	23	03	57
	Last quart.	30	22	54	December.	New moon.	30	15	36
June.	New moon.	06	21	56		First quart.	08	20	55
	First quart.	13	14	09		Full moon.	15	21	42
	Full moon.	21	12	50		Last quart.	22	14	09
	Last quart.	29	13	21		New moon.	30	10	35

Four Eclipses this Year 1708. Two of the Sun, and two of the Moon.

1. Of the Sun, *March 10*, or rather 11, near 7 in the Morning; invisible to us but in the more Southern parts of the World, 'twill be a great Eclipse.
2. Of the Moon, *March 25*, about 6 in the Morning. She will be above half eclipsed, but not much visible to us, because the Sun will rise before the middle of the *Deliquium* be past.
3. Of the Sun, on *September 3*, about 9 in the Morning, visible, the Sun will be 4 Digits. 25 Minutes eclipsed, in N 21 degrees, 23 Minutes, and the North part of his Body loseth Light.
4. Of the Moon, *September 18*, near 9 a clock at Night; at which time the Moon will be almost half eclipsed, viz. 5 Digits, 13 minutes.

A Table of the Moon's Age for the Year 1709. 27

M.		D.	H.	M.	M.		D.	H.	M.
January.	First quart.	07	13	25	July.	First quart.	02	14	02
	Full moon.	14	08	31		Full moon.	10	02	40
	Last quart.	21	03	19		Last quart.	17	08	07
	New moon.	29	06	15		New moon.	25	05	09
February.	First quart.	06	03	21	August.	First quart.	31	21	58
	Full moon.	12	18	40		Full moon.	08	20	32
	Last quart.	19	20	34		Last quart.	16	19	57
	New moon.	28	00	06		New moon.	23	13	24
March.	First quart.	07	13	21	September.	First quart.	30	08	53
	Full moon.	14	04	31		Full moon.	07	12	55
	Last quart.	21	13	28		Last quart.	15	07	03
	New moon.	29	15	34		New moon.	21	02	50
April.	First quart.	05	20	05	October.	First quart.	29	00	51
	Full moon.	12	15	02		Full moon.	07	04	20
	Last quart.	20	08	11		Last quart.	14	14	58
	New moon.	28	03	50		New moon.	21	08	07
May.	First quart.	05	02	06	November.	First quart.	28	20	55
	Full moon.	12	02	12		Full moon.	05	20	57
	Last quart.	20	02	09		Last quart.	12	23	00
	New moon.	27	12	49		New moon.	19	20	47
June.	First quart.	03	08	11	December.	First quart.	27	16	53
	Full moon.	10	14	54		Full moon.	05	11	16
	Last quart.	18	17	07		Last quart.	12	08	03
	New moon.	25	21	48		New moon.	19	12	14
						First quart.	27	14	55

In this Year there will be two Eclipses only, and both of the Sun.

1. The first will happen on *February* the 28th day, a little after Noon, in 20° 53' of κ , and will be almost 3 Digits eclipsed; visible in our Horizon if the Air be clear. 2. The second will happen on *August* the 24th Day, about our One of the Clock in the Morning, therefore invisible to us; but to such who are removed 165 Degrees eastward from *London*, it will be a great Eclipse, and conspicuous in their Meridian.

These Eclipses happening, the one before, and the other after the Sun's *Apogee*, there can be no Full Moon Eclipses in this Year.

M. {	D.	H.	M.	M. {	D.	H.	M.
January.	Full moon.	03	23	58	July.	Last quart.	07 08 47
	Last quart.	10	16	03		New moon.	14 21 10
	New moon.	18	05	38		First quart.	21 15 22
	First quart.	26	09	50		Full moon.	28 22 08
February.	Full moon.	02	10	48	August.	Last quart.	06 01 42
	Last quart.	09	03	07		New moon.	13 05 40
	New moon.	17	00	11		First quart.	19 21 03
	First quart.	25	02	20		Full moon.	27 13 07
March.	Full moon.	03	20	12	September.	Last quart.	04 16 55
	Last quart.	10	15	14		New moon.	11 13 46
	New moon.	18	18	20		First quart.	18 06 14
	First quart.	26	14	27		Full moon.	26 05 40
April.	Full moon.	02	04	54	October.	Last quart.	04 06 17
	Last quart.	09	06	10		New moon.	10 22 40
	New moon.	17	10	20		First quart.	17 19 49
	First quart.	24	22	35		Full moon.	26 00 02
May.	Full moon.	01	13	36	November.	Last quart.	02 17 02
	Last quart.	08	21	55		New moon.	09 09 01
	New moon.	17	00	03		First quart.	16 13 05
	First quart.	24	04	57		Full moon.	24 18 35
	Full Moon.	30	22	58	December.	Last quart.	02 03 12
June.	Last quart.	07	15	40		New moon.	08 20 27
	New moon.	15	11	36		First quart.	16 09 59
	First quart.	22	10	31		Full moon.	24 10 02
	Full moon.	29	09	50		Last quart.	31 12 09

The Year 1710 hath 4 Eclipses, 2 of the Sun, and 2 of the Moon.

The first will be a visible Eclipse of the moon, on Febr. the 2d. day, at 10 hours 38 minutes P. M. in 23 degrees of Ω . The Moon will be 10 Digits eclipsed, and somewhat more. The South side of her Body will be darkned. This Eclipse will be of 2 hours 58 minutes duration. The second will be a visible Eclipse of the Sun on Febr. 17, near Noon, in $\mathcal{H}$ 9 degrees 39 minutes: The Digits eclipsed are almost 7 of 12, and the total duration somewhat above 3 hours. The third will be a Lunar Deliquium, on July 29th day, about 10 in the morning, in 16 degrees of *Aquarius*, invisible as to us. The fourth will be a Solar defect, on August the 13th day, about 5 hours 40 minutes P. M. in the beginning of $\mathcal{H}$, but not visible to us; the Moon's Latit. being then meridional.

A Table of the Moon's Age for the Year 1711.

29

M.	D.	H.	M.	M.	D.	H.	M.
January.	New moon.	07	10	11	July.	New moon.	04 07 07
	First quart.	15	07	13		First quart.	11 10 57
	Full moon.	23	00	04		Full moon.	18 05 52
	Last quart.	29	19	50		Last quart.	25 22 33
February.	New moon.	06	01	42	August.	New moon.	02 18 26
	First quart.	14	04	18		First quart.	09 16 02
	Full moon.	21	12	06		Full moon.	16 16 58
	Last quart.	28	04	21		Last quart.	24 16 18
March.	New moon.	07	18	06	September.	New moon.	01 05 10
	First quart.	16	00	44		First quart.	07 22 33
	Full Moon.	22	22	28		Full moon.	15 06 46
	Last quart.	29	14	02		Last quart.	23 11 04
April.	New moon.	06	11	06	October.	New moon.	30 14 21
	First quart.	14	12	21		First quart.	07 06 35
	Full moon.	21	05	34		Full moon.	15 00 44
	Last quart.	28	00	43		Last quart.	23 03 21
May.	New moon.	06	03	08	November.	New moon.	30 00 44
	First quart.	13	22	29		First quart.	05 18 04
	Full moon.	20	12	56		Full moon.	13 18 12
	Last quart.	27	14	08		Last quart.	21 18 02
June.	New moon.	04	17	55	December.	New moon.	28 10 54
	First quart.	12	06	11		First quart.	05 08 14
	Full moon.	18	20	40		Full moon.	13 13 31
	Last quart.	27	05	07		Last quart.	21 06 15
						New moon.	27 21 44

Five Eclipses this Year, three of the Sun, and two of the Moon.

The first will be of the Sun *January* the 7th, about our ten a Clock at Night, in the latter part of *Capricornus*, but to us Invisible. The second will be of the Moon on *January*, the 23d day about Noon; it falls in *Leo* 14 degrees, but will be only visible in our *Antipodes*, where it will appear a very great Eclipse. The third will be a small defect of the Sun on *February* the 6th day, near two a Clock P. M. in the latter part of *Aquarius*; this will be Invisible to us by reason of the Moon's great North Latitude: So that not above one whole Digit of 12 will be Darkened. The fourth will be a visible Eclipse of the Sun, on *July* the 4th, about 7 hours P. M. in *Cancer* 22 degrees, and more than 9 Digits of the Sun's Body will be obscured: the duration near 2 hours. The fifth will be a Lunar Defect *July* 18th, about our six a Clock at Night, in six degrees of *Aquarius*; but to us in *England* Invisible.

M. {		D.	H.	M.	M. {		D.	H.	M.
January.	First quart.	04	03	19	July.	Full moon.	06	20	30
	Full moon.	12	07	50		Last quart.	13	21	50
	Last quart.	19	15	45		New moon.	22	01	21
	New moon.	26	10	10		First quart.	29	13	18
February.	First quart.	03	00	06	August.	Full moon.	05	04	23
	Full moon.	10	23	46		Last quart.	12	13	25
	Last quart.	18	00	05		New moon.	20	15	02
	New moon.	24	23	14		First quart.	27	19	47
March.	First quart.	03	21	15	September.	Full moon.	03	14	27
	Full moon.	11	13	16		Last quart.	11	07	31
	Last quart.	18	07	14		New moon.	19	03	50
	New moon.	25	13	10		First quart.	26	01	04
April.	First quart.	02	15	51	October.	Full moon.	03	08	08
	Full moon.	09	22	17		Last quart.	11	03	54
	Last quart.	16	14	40		New moon.	18	15	48
	New moon.	24	04	06		First quart.	25	09	03
May.	First quart.	02	07	50	November.	Full moon.	01	15	42
	Full moon.	09	06	22		Last quart.	09	23	12
	Last quart.	15	22	13		New moon.	17	03	02
	New moon.	23	19	24		First quart.	23	18	41
June.	First quart.	31	22	03	December.	Full Moon.	01	12	58
	Full moon.	07	13	14		Last quart.	09	17	22
	Last quart.	14	08	12		New moon.	16	13	36
	New moon.	22	10	40		First quart.	23	08	01
	First quart.	30	06	01		Full moon.	31	07	55

The Year 1712 hath 4 Eclipses, 2 of the Sun, and 2 of the Moon

The first will be a visible Eclipse of the moon, about our 8 a Clock at Night in 3 Digits of *Leo*, when the Moon will be almost 4 Digits darkened: It's continuance will be 2 Hours and upwards. The second will be a Solar *Deliquium*, on *June* the 22d, near our 11 a Clock, Invisible to us: It's celebrated in 12 Degrees of *Cancer*, or the Celestial Crab. The third shall be a small *Lunar* Defect on *July* 17th, at half an Hour after 8 a Clock in the Morning, in the latter part of *Taurus* but Invisible in our *Hemisphere*. The fourth will be an Eclipse of the Sun, on *December* the 16th, at 13 Hours 36 Minutes *P.M.* and therefore Invisible to us: But in it self will be a very great Eclipse, and seen by our *Antipodes*.

A Table of the Moon's Age for the Year 1713: 31

M.	D.	H.	M.	M.	D.	H.	M.
January.	Last quart.	08	08	07	July.	Last quart.	03 06 10
	New moon.	15	00	10		New moon.	11 20 32
	First quart.	21	22	09		First quart.	19 04 03
	Full moon.	30	03	47		Full moon.	25 02 12
February.	Last quart.	06	20	01	August.	Last quart.	01 16 11
	New moon.	13	10	35		New moon.	09 17 52
	First quart.	20	17	10		First quart.	17 14 09
	Full moon.	28	20	39		Full moon.	24 04 40
March.	Last quart.	08	04	09	September.	Last quart.	31 05 08
	New moon.	14	22	26		New moon.	08 09 40
	First quart.	22	10	33		First quart.	15 22 13
	Full moon.	30	10	35		Full moon.	22 13 48
April.	Last quart.	06	11	01	October.	Last quart.	29 23 08
	New moon.	13	09	10		New moon.	08 01 08
	First quart.	21	07	18		First quart.	15 05 17
	Full moon.	28	21	32		Full moon.	21 22 49
May.	Last quart.	05	16	03	November.	Last quart.	29 20 02
	New moon.	12	21	47		New moon.	06 08 29
	First quart.	21	09	09		First quart.	13 13 05
	Full moon.	25	06	29		Full moon.	20 15 22
June.	Last quart.	03	22	01	December.	Last quart.	28 17 15
	New moon.	11	11	29		New moon.	06 04 22
	First quart.	19	15	29		First quart.	12 22 14
	Full moon.	26	13	10		Full moon.	20 08 25
						Last quart.	28 13 19

In the Year 1713, will be four Eclipses, 2 of the Sun, and 2 of the Moon.

The first will be an Invisible Lunar Defect, on May the 28th Day at near half an Hour after 6 at Night. It will be a small Eclipse in 17 Degrees, 39 Minutes of Sagittarius. The second will be a Solar Deliquium, on June the 11th day about our half an Hour after 11 a Clock at Night. It is made in 1 Degree, 11 Minutes of Cancer, Invisible to us; visible to our Antipodes. The third will be a Lunar Eclipse on November the 21st day, at our 3 of the Clock in the Morning. This will be visible to us; and half the Moons Body will be obscured, in 9 Degrees, 49 Minutes of Gemini. The fourth will be a Solar Deliquium, on December the 6th day, at 22 Minutes after 4 a Clock P. M. but the Sun being then below the Western Horizon, it cannot be seen of us. It is Celebrated in 25 Degrees, 42 Minutes of Sagittarius.

32 A Table of the Moon's Age for the Year 1714.

M. {		D.	H.	M.	M. {		D.	H.	M.
January.	New moon.	04	15	56	July.	First quart.	08	07	03
	First quart.	11	08	11		Full Moon.	15	13	06
	Full moon.	19	03	06		Last quart.	22	05	26
	Last quart.	27	06	24		New moon.	29	18	40
February.	New moon.	03	02	25	August.	First quart.	06	22	07
	First quart.	09	20	04		Full moon.	13	20	52
	Full moon.	17	22	02		Last quart.	20	13	04
	Last quart.	25	21	50		New moon.	28	10	29
March.	New moon.	04	11	44	September.	First quart.	05	12	03
	First quart.	11	11	07		Full moon.	12	05	24
	Full moon.	19	15	31		Last quart.	19	00	37
	Last quart.	27	06	24		New moon.	27	03	35
April.	New moon.	02	20	43	October.	First quart.	04	23	03
	First quart.	10	04	39		Full moon.	11	14	28
	Full moon.	15	06	34		Last quart.	18	16	04
	Last quart.	25	13	04		New moon.	26	20	54
May.	New moon.	02	06	11	November.	First quart.	03	09	01
	First quart.	09	20	07		Full moon.	10	00	56
	Full moon.	17	18	56		Last quart.	17	11	03
	Last quart.	24	19	11		New moon.	25	12	46
	New moon.	31	16	47	December.	First quart.	02	17	02
June.	First quart.	08	14	27		Full moon.	09	13	20
	Full moon.	16	04	52		Last quart.	17	09	03
	Last quart.	22	23	08		New moon.	25	04	12
	New moon.	30	04	46					

In this year 1714, we shall meet with five Luminarian Eclipses, two of the Sun and two of the Moon.

The first will be a Solar Eclipse, on May the 2d. about 6 hours Afternoon, in *Taurus* 22 Deg. 24 Min. invisible to us. The second will be a Lunar Defect on May the 18th, near 7 a Clock in the Morning, in *Sagittarius* 7 Deg. 12 Min. invisible to us. The third will be a Solar Deliquium, on July the 1st, about our 5 a Clock in the Morning, in *Gemini* 20 Deg. 41 Min. invisible. The fourth will be an Eclipse of the Sun, on October the 27th, near our 9 a Clock in the Morning, in *Virgo* 14 Deg. 31 Min. but not visible to us in *England*. The fifth will be a Lunar Deliquium, on November the 10th, a little past 1 a Clock Afternoon, in *Taurus* 28 Deg. 50 Min. It will be a great Eclipse to such as Inhabit our Antipodes, viz. not only Total, but nearly Central.

The Use of the foregoing Table of the Moon's Age.

IN the said Table the one half Page contains the first six Months of the Year, the other half the following six Months: In the first Column of each half, towards the left hand, are the Months; in the second, the New, Full and Quarters of the Moon; in the three following Columns are the Days, Hours and Minutes, of the said New, Full and Quarters; which time is accounted from Noon to Noon. At the bottom of the Tables are the Eclipses for the respective Years.

The Use of this Table is readily, by Inspection, to find the Day, Hour and Minute, of the New, Full, or Quarters of the Moon.

Example.

Suppose it were desired to find the time of New Moon in Jan. 1710.

First, Look for the Year 1710, on the top of the Leaf, which having found, look for January in the first Column towards the left hand; then in the next Column, in the same Month, is found New Moon; and in the three following Columns, against New Moon, stand 18:05:38, which shews that the New Moon in January 1710, is the 18th Day, 5 Hours, 38 Minutes Afternoon. The same Directions and Considerations serve for the Full Moon, or first and last Quarters.

Note; That when the Moon is in the first Quarter, it is 8 days old, at the full 15 days, and in the last Quarter 22 days. Suppose therefore it were required to find the Moon's Age on March 25, 1710.

Looking in the Year 1710, the Table gives the New Moon to be on the 18th day, therefore 18 and 7 being 25, it appears the Moon is 7 days old on the 25th of March.

Example. 2. Suppose it were required to find the Moon's Age on the 26th of June, 1710.

Looking in the Year 1710, in the Month of June, I find the Moon to be in the first Quarter on the 22d. day, that is, 8 days old; then the day for which I would find its Age, being 4 days after; I conclude the Moon to be 12 days old on the said 26th day of June, 1710.

A Tide Table for the Sea Coasts of Great Britain, Ireland, Norway, Holland, Flanders, France, Biscay, &c. Shewing what Moon makes Full Sea upon the Full and Change-days, at the Places following, in Alphabetical Order.

A		H.	M.		H.	M.
A	T Armys, N.N.E. and S.S.W.	01	30	At Abermorick, and Antwerp,		
	At Amsterdam, and Armentiers, North east, and S.W.	03	00	East and West.	06	00
	At Abarmark, E. N. E. and W.S.W.	04	30	At Alborough, S.E. by S. and N.W. by N.	09	45
		E		At		

B		H.M.			H.M.
At <i>Beachy</i> , and before the Race of <i>Blanquet</i> , N. and S.—	12 00		At <i>Cork</i> , at <i>Calice</i> , and in the Creek, E. N. E. and W. S. W.—	04 30	
At <i>Blacktail</i> , and thwart of <i>Beachy</i> in the <i>Offing</i> , N. by E. and South by W.—	12 45		At <i>Caldy</i> , and in the Bay of <i>Carnarvan</i> , East by North, and West by South.—	05 15	
At <i>Blacknefs</i> in <i>Bluet</i> , at <i>Bell- Isle</i> , at <i>Berwick</i> , N. N. E. and S. S. W.—	01 30		At <i>Cancalo</i> , East and West—	06 00	
Without <i>Bluet</i> , N. E. by N. and S. W. by S.—	02 15		At <i>Cape Cleer</i> , E. S. E. and W. N. N.—	07 30	
The River of <i>Bordeaux</i> , the South-Coast of <i>Britaign</i> , the Coast of <i>Biscay</i> , and at <i>Rocknefs</i> N. E. and S. W.—	03 30		Without the <i>Caskets</i> , in the Channel, S. E. by E. N. W. by W.—	08 15	
At <i>Brest</i> , before the <i>Bafs</i> , the River of <i>Bordeaux</i> within the Haven, and at <i>Berwick</i> , N. E. by E. and S. W. by W.—	03 45		Between <i>Guernsey</i> and the <i>Caskets</i> , before <i>Cromer</i> , before the <i>Caskets</i> and <i>Guernsey</i> , at <i>Seven-Cliffs</i> , and at <i>Catenefs</i> , S. E. and N. W.—	09 00	
In the <i>Bree-sound</i> , <i>Bloy</i> , <i>Balti- more</i> , E. N. E. and W. S. W.—	04 30		At the <i>Caskets</i> , and at <i>Cham- bernefs</i> , S. E. by S. and N. W. by North—	09 45	
Before <i>Breman</i> , and at <i>Black- ney</i> , in the Channel before <i>Bou- deaux</i> and at <i>Bristol</i> , East and West—	06 00		At <i>Cows</i> , in the <i>Fofs</i> of <i>Caen</i> , in <i>Calice-Road</i> , and in <i>Chamber- nefs-Road</i> , S. S. E. and N. N. W.—	10 30	
At <i>Bristol-Key</i> , East by South and West by North—	06 45		Before the Haven of <i>Caen</i> , in the <i>Chamber</i> , between <i>Crip- ple-Sand</i> and the <i>Creyt</i> , and at <i>Calshot</i> , S. by E. and N. by W.—	11 15	
At <i>Bridgwater</i> , E. S. E. and W. N. W.—	07 30		D		
Between <i>Beachy</i> and the <i>Isle of Wight</i> , S. E. by E. and N. W. by W.—	08 15		At <i>Dover-Peer</i> , and before <i>Dunkirk</i> , North and South—	12 00	
<i>Bulleyn-deep</i> , S. S. E. and N. N. W.—	10 30		At <i>Denbigh</i> N. E. by N. and S. W. by S.—	02 15	
C			At <i>Dort</i> , N. E. and S. W.—	03 00	
In the <i>Condado</i> , N. and S.—	12 00		At <i>Dungarven</i> , E. N. E. and W. S. W.—	04 30	
In the <i>Chamber</i> of <i>Rye</i> , N. by East, and S. by W.—	12 45		At <i>Dartmouth</i> , East and West At <i>Dublin</i> S. E. by East and N. W. by W.—	06 00	
Without <i>Calice</i> , at <i>Corpus Christi</i> Point, before <i>Camfere</i> , and at <i>Camfers</i> , N. N. E. and S. S. W.—	01 30		At <i>Dunbar</i> , S. E. and N. W.—	09 00	
Between <i>Calice</i> , and <i>Dover</i> , before <i>Conquet</i> , and at the <i>North Cape</i> , N. E. and S. W.—	03 00		At <i>Dungenefs</i> , and <i>Dunnofe</i> , S. E. by S. and N. W. by N.—	09 45	
			At <i>Dover</i> and in the <i>Downs</i> , S. S. E. and N. N. W.—	10 30	

The Tide-Table.

35

E	H. M.	H. M.
At <i>Embsen</i> , before the <i>Elor</i> , before the <i>Eyder</i> , and before <i>Enchusen</i> , North and South—	12 00	At <i>Guernsey</i> , E. by N. and W. by S. ————— 05 15
At <i>Edam</i> , N. N. E. and S. S. W. Before the <i>Eastern</i> and <i>Western Fmes</i> , and at <i>Egmont</i> , S. E. and N. W. —————	00 03 09 00	Between <i>Guernsey</i> and <i>Caskets</i> S. E. and N. W. ————— 09 00
F.		Thwart of <i>Guernsey</i> in the Channel, S. E. by S. and N. W. by N. ————— 09 45
On the Coast of <i>Flanders</i> , North and South —————	12 00	In the <i>Chamber</i> and <i>Gore-end</i> , S. by E. and N. by W. ————— 11 15
At <i>Flushing</i> , North by East, and South by West —————	12 45	H.
Before the <i>Fen</i> , in the Chan- nel, N. N. E. and S. S. W. —————	01 30	Before the <i>Hever</i> , before <i>Horn</i> , and at <i>Hampton-Key</i> , North and South. ————— 12 00
Without <i>Fountnay</i> , N. E. by N. and S. W. by S. —————	02 15	Under <i>Holy Island</i> , and at <i>Horn</i> , N. N. E. and S. S. W. ————— 01 30
Without the Banks of <i>Flan- ders</i> , N. E. and S. W. —————	03 00	Before <i>Hartle-pool</i> , N. E. and S. W. ————— 03 00
At <i>Flambrough</i> and <i>Brid- lington</i> , E. N. E. and W. S. W. —————	04 30	At <i>Huncoff-foot</i> N. E. by E. and S. W. by W. ————— 03 45
At the <i>Fown</i> , in <i>Foy</i> , at <i>Fal- mouth</i> , E. by N. and W. by S. —————	05 15	At <i>Humber</i> , East by North, and West by South. ————— 05 15
Between <i>Foy</i> and <i>Falmonth</i> , in the Channel, and at <i>Foulness</i> , E. by S. and W. by N. —————	06 45	Before <i>Hamborough</i> , at <i>Hull</i> , at the <i>Holms</i> , and before <i>Hum- ber's Mouth</i> , East and West. ————— 06 00
Before the Coast of <i>Friezland</i> , and the <i>Fly</i> , E. S. E. and W. N. W. —————	07 30	At <i>Harlem</i> and at <i>Home-head</i> , S. E. and N. W. ————— 09 00
Without the <i>Fly</i> , S. E. by E. and N. W. by W. —————	08 15	At <i>St. Hellens</i> , at <i>Harwich</i> , and without the Banks of <i>Har- wich</i> , S. S. E. and N. N. W. ————— 10 30
At <i>Friez</i> , and <i>Fair-Isles</i> N. W. and S. E. —————	09 00	At <i>Harwich</i> within, South by East, and North by West. ————— 11 15
In the <i>Frith</i> , and at the <i>South Foreland</i> , S. S. E. and N. N. W. —————	10 30	I.
In <i>Fair-Isto</i> Roads, and at the <i>North-Foreland</i> , S. by E. and N. by W. —————	11 15	At <i>Jutland-Islands</i> , N. and S. — 12 00
G.		On the West Coast of <i>Ir- land</i> , N. E. and S. W. ————— 03 00
In the Road of <i>Gibraltar</i> , at <i>Graveling</i> , and before <i>Cherburg</i> , N. and S. —————	12 00	In all the Havens on the South Coast of <i>Ireland</i> , East by North, and West by South. — 05 15
Before <i>Goree</i> , and at <i>Graves- end</i> , N. N. E. and S. S. W. —————	01 30	K.
At <i>Groy</i> , at <i>Gascoign</i> , and the Coast of <i>Galicia</i> , N. E. and S. W. — 03 00		<i>Kentish Knuck</i> , N. and S. — 12 00
		At <i>Killians</i> , N. E. and S. W. — 03 00
		At <i>Kingale</i> , E. N. E. and W. S. W. ————— 04 30
		At <i>Kilduyn</i> , E. S. E. and W. N. W. ————— 07 30

At Kildive, S.E. and N.W. —	09 00	H. M. Before Newcastle, and before the River of Nants, N.E. & S.W. —	03 00	H. M.
L.		At Newcastle, E. by N. & W. by S. —	05 15	
At Leigh, North and South —	12 00	Before St. Nicholas East by South, and West by North. —	06 45	
At Lisbon, N. E. by N. and S. W. by S. —	02 15	At the Needles, at the Isle of Wight, S.E. by East, and N.W. by West —	08 15	
At London, N.E. and S.W. —	03 00	All the Coast of Normandy and Picardy, S.S.E. and N.N.W. —	10 30	
Thwart of Londey, and before Lin, E. by N. and W. by S. —	05 15	Between the Naze, and Warhead of Lower, South by East, and North by West —	11 15	
At Lin, half Tide, at Londey, East and West. —	06 00	O.		
At Lime E. by S. and W. by N. —	06 45	At Orkneys N.E. and S.W. —	03 00	
At the Lizard, by the Land, E.S.E. and W.N.W. —	07 30	At Orkney S.E. and N.W. —	09 00	
At Limbay, S. E. by E. and N.W. by W. —	08 15	At Orfordness S.E. by S. and N.W. by N. —	09 45	
At Leystaff, and thwart of it without the Banks, S. E. by and N. W. by N. —	09 45	At Orfordness without the Banks, and between Orford and Orwel-Waves S.S.E. & N.N.W. —	10 30	
In Leystaff Road, at Long-sand-head S.S.E. and N.N.W. —	10 30	At Orfordness within the Sands, S. by E. and N. by W. —	11 15	
M.		P.		
Within the Maes, at Malden, N. by E. and S. by W. —	12 45	At Portsmouth, Half-Tide, North and South —	12 00	
Before the Maes, N.N.E. and S. S. W. —	01 30	At the Penns, Porthus, and Pitou N. E. and S. W. —	03 00	
At the Maes, before S. Matthews Point, N.E. by E. and S.W. by W. —	03 45	On the Coast of Portugal, N.E. by E. and S.W. by W. —	03 45	
In Mousehole, at St. Matthews and within Mounts-bay, E.N.E. and W.S.W. —	04 30	In Plymouth, and before St. Pauls, E. by N. and W. by S. —	05 15	
In Milford, at Moonles, at St. Maloes, E. by N. and W. by S. —	05 15	At St. Pauls in the Haven, East and West —	06 00	
Between Mousehole and Falmouth, and in Milford-Haven, E.S.E. and W.N.W. —	07 30	Before Podesfinks, East by South, and West by North —	06 45	
In St. Magnes-Sound, and at Machnells Castle, S.E. by E. and N. W. by W. —	08 15	Thwart of Plymouth, E.S.E. and W.N.W. —	07 30	
At the Isle of Man, S.E. and N.W. —	09 00	At the Race of Portland S.E. and N. W. —	09 00	
Before Margate, South by East and North by West. —	11 15	Q.		
N.		At Quinborough N. and S. —	12 00	
At Newport, Half-tide, North and South —	12 00	R.		
At the west end of the Nower N. by E. and S. by W. —	12 45	Rochester N. by E. and S. by W. —	12 45	
		At Ramkins, N.N.E. & S.S.W. —	01 30	
		At Rotterdam, in Robin-Hoods Bay, and from the Race to the		

The Tide-Table.

37

H.M.	At Tergou, S. E. by South,	H.M.
Pole-head N.E. and S.W. ———	and N. W. by North. ———	09 45
At Rouen, and before Rochel, N.	V.	
E. by East, and S.W. by West. ———	Before Ureck, N. and South. ———	12 00
In Ramsay, E. by N. & W. by S. ———	At Use N.E. and S. W. ———	03 00
In Russia, E. by S. and W. by N. ———	Between Ushant and the	
S.	Main, N.E. by E. and S.W. by W. ———	03 45
In the Sleeve, between U-	In the Vour, at the Bay with-	
shant and Silly, at the Shooe, at	in Ushant, E.N.E. and W.S.W. ———	04 30
the Spit, at South-Hampton, and	Without Ushant, E. and W. ———	06 00
along the Swin, N. and S. ———	W.	
Upon the Coast of Spain, and	At Winchelsey, N.b.E. & S. by W. ———	12 45
in Sberland, N. E. and S. W. ———	At the Weilings, and from	
At Silly, in the Sound, at Staples	the West end of the Wight,	
N.E. by East, S.W. by W. ———	N.N.E. and S.S.W. ———	01 30
Before Scarborough, at 7 Isles,	Before the Weilings, N.E. by	
without the Haven in the broad	North, and S.W. by South. ———	02 15
Sound, E.N.E. and W.S.W. ———	In the Sea of Wales, and Se-	
At the Mouth of Severn, be-	vern, E.N.E. and W.S.W. ———	04 30
tween Silly and the Lizard, at	In Wales, E.b.N. and W. by S. ———	05 15
the Spurn, E. by N. and W. by S. ———	At Wells, at Weymouth, and	
Without Silly, in the Channel	at Waterford, East and West. ———	06 00
at Salcomb, East and West. ———	At Weymouth Key, East by	
At Sedmouth, and at the Start,	South, and West by North. ———	06 45
E. by S. and W. by N. ———	At the Nefs by Wieringhen, at	
Off the Start, in the Channel	Winterton, E.S.E. and W.N.W. ———	07 30
E.S.E. and W.N.W. ———	Thwart of the Isle of Wight,	
Within the Seyn, and before	in the Channel, all within the	
Schelbalgh, and at Seven Clifts,	Isle of Wight, between the Isle	
S.E. and N.W. ———	of Wighe and Beachy by the	
At Shoram, S. E. by South	Shore, S.E. by E. N.W. by W. ———	08 15
and N.W. by North. ———	At the East-end of the Wight	
At Seyn-head, S.S.E. & N.N.W.	and on Wieringhen Flats, S. E.	
T.	and N. W. ———	09 00
Within Tervere, N. by E. and	Y.	
S. by West. ———	Before Yarmouth, N N. E.	
Before Tervere, before the	and S.S.W. ———	01 30
River of Thames, and at Tin-	At Youghall, E. N. E. and	
mouth, N.N.E. and S.S.W. ———	W. S. W. ———	04 30
Before the Tees, before the	At Yarmouth, S. E. by East,	
Bay of Tinmouth, N. E. and S.W. ———	and N. W. by West ———	08 15
At the Clefts of the Texel,	In Yarmouth Road, in Yarmouth	
E.N.E. and W. S. W. ———	Haven, S.S.E. and N.N.W. ———	10 30
In Torbay, and before the	Z.	
Texel, East and West. ———	On the Coast of Zealand	
In the Road of the Texel,	N.N.E. and S.S.W. ———	01 30
E.S.E. and W.N.W. ———	In the Zeirick-Sea, N.E. & S.W. ———	03 00

THE

THE foregoing Table shews the time of Full-Sea, at the several Places therein mentioned, upon the Full and Change-days of the Moon, which for more ready use is put in Alphabetical order.

Example Admit the time of Full-Sea at *London*, upon the Full and Change-days, be required.

Look in the Table under the Letter (L) it is found to flow at *London* North-east and South-west, that is, when it is Full-Sea at *London* upon the Full and Change days, the Moon will be, (as 'tis vulgarly said) upon the North-east, and South-west Points of the Compass, which, (as the Compass shews) is at 2 Hours.

The use of this, together with the Moon's Southing, to find the time of Full-sea at any time, at any of the said Places, shall be shewn below.

To find the Moon's Southing.

To find the Southing of the Moon, multiply the Moon's Age by 4 and divide the Product by 5, and the Quotient of the Division is the time of Southing.

Note, If the Moon's Age exceed 15, reject the said 15, and take the Remainder, with which proceed instead of the Moon's Age.

Example. Suppose the time of the Moon's Southing be required on the 18th of June 1709. The Moon's Age will be found to be 22 days; rejecting 15, the Remainder is 7; which multiplied by 4 makes 28, which divided by 5, gives in the Quotient 5 Hours 36 Minutes, which is the time of the Moon's Southing, which was required.

Note; Every 1 that remains after Division, is 12 Minutes.

I shall here add a Table of the Moon's Southing to every day of her Age.

Moon's Age.	Southing.	
	H.	M.
01—16	00	48
02—17	01	36
03—18	02	25
04—19	03	12
05—20	04	00
06—21	04	48
07—22	05	36
08—23	06	24
09—24	07	12
10—25	08	00
11—26	08	48
12—27	09	36
13—28	10	24
14—29	11	12
15—30	12	00

The use of the Table.

The first and Second Columns shew the Moon's Age, the Third the Southing.

Example.

The Moon being 9 Days old, and her southing required.

In the first Colum, under the Title *Moon's Age* stands 9; over against it, in the last Column, is 7 hours 12 Minutes, the time of the southing required.

Note also, the same southing serves for 24 Days old, as serves for 9 Days, as the Table shews.

Thus

Thus having got the Moon's Southing, proceed to find the time of Full Sea, as follows.

Suppose the Moon being 9 Days old, the time of Full-sea in the Downs required.

By the foregoing Table it appears that a N. N. W. and S. S. E. Moon makes full-sea upon the Full and Change-days, which (as the said Table shews) is 10 Hours 30 Minutes; to which adding the Moon's Southing at 9 days old (*viz.* 7 hours 12 minutes) it makes 17 hours 42 minutes, or 1 hours 42 minutes, rejecting 12 hours.

But to be more exact, use the following Table and Directions.

Moon's Age.	Tide.	
	H.	M.
01 — 16	00	43
02 — 17	01	20
03 — 18	01	52
04 — 19	02	22
05 — 20	02	52
06 — 21	03	26
07 — 22	04	07
08 — 23	04	55
09 — 24	05	50
10 — 25	06	53
11 — 26	07	59
12 — 27	09	04
13 — 28	10	08
14 — 29	11	05
15 — 30	00	00

Having found the time of full-Sea upon the Full and Change-days, by the preceding Table for that purpose, enter this Table with the Moon's Age; against which in the last Column are the Hours and Minutes to be added for the time of Full-sea desired.

Example.

Suppose, as before, the Moon being 9 Days old, and the time of Full-Sea in the Downs is required.

A N.N.W. and S.S.E. Moon making full-Sea upon the Full and Change-days, which is 10 hours 30 min. which being found, enter this Table with the Moon's Age 9 days, against which stands 5 Hours 50 Min. which added to 10 Hours 30 Minutes, makes 16 Hours 20 Minutes, or 4 Hours 20 Min. rejecting 12 Hours.

Here follows,

A New and Exact KALENDAR

O F

The Sun's Place and Declination to every Day of the Year, for First, Second, Third and Leap-Years, diligently corrected. Likewise the Sun's Rising, whereby may be found the time of Setting, and Length of the Day and Night; together with the Southing of the principal fixed Stars at Midnight.

January.

Month	Week days	Remarkable days, & sou-thing of stars at midnight.	First Year.		Second Year.		Third Year.		Leap-Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
Month days.			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			vs.	South.	vs.	South.	vs.	South.	vs.	South.
1	A	Circumcif.	22 13	21 39	21 58	21 41	21 44	21 43	21 29	21 46
2	B	Sun rise 8.	23 14	21 28	22 59	21 31	22 45	21 33	22 30	21 36
3	C		24 15	21 18	23 01	21 21	23 46	21 23	23 31	21 26
4	D		25 16	21 07	25 02	21 10	24 47	21 12	24 32	21 15
5	E		26 18	20 56	26 03	20 59	25 48	21 01	25 33	21 04
6	F	Epiphany.	27 19	20 44	27 04	20 47	26 49	20 50	26 34	20 53
7	G		28 20	20 32	28 05	20 35	27 50	20 38	27 35	20 41
8	A		29 21	20 19	29 06	20 22	28 51	20 25	28 36	20 29
9	B		☾. 22	20 06	☾. 07	20 10	29 52	20 13	29 37	20 16
10	C		01 23	19 53	01 08	19 56	☾. 53	20 00	☾. 38	20 03
11	D	Sol in Aquar.	02 24	19 38	02 09	19 43	01 54	19 46	01 39	19 50
12	E	Sun r. 7.45	03 25	19 25	03 10	19 29	02 55	19 32	02 40	19 36
13	F		04 26	19 11	04 11	19 15	03 56	19 18	03 41	19 22
14	G		05 27	18 56	05 12	19 00	04 57	19 04	04 42	19 07
15	A		06 28	18 41	06 13	18 45	05 58	18 49	05 43	18 52
16	B		07 29	18 26	07 14	18 30	06 59	18 33	06 44	18 37
17	C		08 30	18 10	08 15	18 24	08 00	18 18	07 45	18 21
18	D		09 31	17 54	09 16	17 58	09 01	18 02	08 46	18 06
19	E		10 32	17 38	10 17	17 42	10 02	17 46	09 47	17 50
20	F		11 32	17 21	11 17	17 25	11 03	17 29	10 48	17 34
21	G		12 33	17 04	12 18	17 08	12 03	17 13	11 49	17 17
22	A	Sun r. 7.30	13 34	16 47	13 19	16 51	13 04	16 55	12 50	17 00
23	B		14 35	16 29	14 20	16 34	14 05	16 38	13 50	16 42
24	C	Hydra's heart	15 35	16 12	15 21	16 16	15 06	16 20	14 51	16 25
25	D	Co S. Paul.	16 36	15 53	16 21	15 58	16 07	16 02	15 52	16 07
26	E		17 37	15 35	17 22	15 39	17 07	15 44	16 53	15 48
27	F		18 38	15 16	18 23	15 21	18 08	15 25	17 53	15 30
28	G		19 38	14 57	19 23	15 02	19 09	15 07	18 54	15 11
29	A		20 39	14 38	20 24	14 43	20 09	14 48	19 55	14 52
30	B	K. Char. B.	21 40	14 19	21 24	14 23	21 10	14 28	20 55	14 33
31	C		22 40	13 59	22 25	14 04	22 11	14 09	21 56	14 13

February hath XXVIII days.

41

Month days.	Week days.	Remarkable days, & something of stars at midnight.	First Year.		Second Year.		Third Year.		Leap Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			☿.	South.	☿.	South.	☿.	South.	☿.	South.
1	D		23 41	13 39	23 26	13 44	23 11	13 49	22 57	13 54
2	E	Purif Mary	24 41	13 19	24 26	13 24	24 12	13 29	23 57	13 34
3	F	Lions Heart.	25 42	12 59	25 27	13 04	25 12	13 09	24 58	13 14
4	G		26 42	12 38	26 28	12 43	26 13	12 48	25 58	12 53
5	A		27 43	12 17	27 28	12 22	27 13	12 27	26 59	12 33
6	B	Lions Neck.	28 43	11 56	28 28	12 01	28 14	12 06	27 59	12 12
7	C	Sun r. 7. 1.	29 44	11 35	29 29	11 40	29 14	11 46	29 00	11 51
8	D	Sol in Pisces.	☿. 44	11 14	☿. 29	11 19	☿. 15	11 24	☿. 00	11 30
9	E		01 44	10 53	01 30	10 58	01 15	11 03	01 00	11 08
10	F		02 45	10 31	02 30	10 36	02 15	10 41	02 01	10 47
11	G		03 45	10 09	03 30	10 14	03 16	10 20	03 01	10 25
12	A		04 45	09 47	04 31	09 52	04 16	09 58	04 01	10 03
13	B		05 45	09 25	05 31	09 30	05 16	09 36	05 02	09 41
14	C	Valentine.	06 46	09 03	06 31	09 08	06 16	09 14	06 02	09 19
15	D	Sun r. 6. 45	07 46	08 40	07 31	08 46	07 17	08 51	07 02	08 57
16	E	Lower of	08 46	08 18	08 31	08 23	08 17	08 29	08 02	08 34
17	F	two fore-	09 46	07 55	09 32	08 01	09 17	08 06	09 02	08 12
18	G	most in ☐ of	10 46	07 32	10 32	07 38	10 17	07 44	10 03	07 49
19	A	great Bear.	11 46	07 10	11 32	07 15	11 17	07 21	11 03	07 26
20	B		12 46	06 47	12 32	06 52	12 17	06 58	12 03	07 03
21	C		13 46	06 24	13 32	06 29	13 17	06 35	13 03	06 40
22	D		14 46	06 01	14 32	06 06	14 17	06 12	14 03	06 17
23	E	Sun r. 6. 30	15 46	05 37	15 32	05 43	15 17	05 49	15 03	05 54
24	F		16 46	05 14	16 32	05 20	16 17	05 25	16 03	05 31
25	G	S. Matthias	17 46	04 51	17 32	04 57	17 17	05 02	17 02	05 08
26	A		18 46	04 27	18 31	04 33	18 17	04 39	18 02	04 44
27	B		19 46	04 04	19 31	04 09	19 17	04 15	19 02	04 21
28	C		20 45	03 40	20 31	03 46	20 16	03 52	20 02	03 57
29	D		When it is Leap-Year, February hath 29 days.							21 02 03 34

March hath XXXI Days.

Month days.	Week days.	Remarkable days, & fouthing of stars at midnight.	First Year.		Second Year.		Third Year.		Leap Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			℥.	South.	℥.	South.	℥.	South.	℥.	South.
1	D	David.	21 45	03 17	21 31	03 22	21 16	03 28	22 01	03 10
2	E	Lion's Tail.	22 45	02 53	22 30	02 59	22 16	03 04	23 01	02 47
3	F	Lower of the	23 45	02 29	23 30	02 35	23 16	02 41	24 01	02 23
4	G	two latter, in	24 44	02 05	24 30	02 11	24 15	02 17	25 00	01 59
		☐ of Great								
5	A	Bear.	25 44	01 42	25 29	01 48	25 15	01 54	26 00	01 36
6	B		26 43	01 18	26 29	01 24	26 14	01 30	27 00	01 12
7	C		27 43	00 54	27 28	01 00	27 14	01 06	27 59	00 48
8	D		28 42	00 31	28 28	00 37	28 13	00 43	28 59	00 25
9	E		29 42	00 07	29 27	00 13	29 13	00 19	29 58	00 01
10	F	Sun r. 6. 4.	℥. 41	Nor 16	℥. 27	Nor 10	℥. 12	Nor 05	℥. 57	Nor 23
11	G	Upper of	01 41	00 40	01 26	00 34	01 12	00 28	01 57	00 46
12	A	two latter in	02 40	01 04	02 25	00 58	02 11	00 52	02 56	01 10
		☐ of Great								
13	B	Bear.	03 39	01 27	03 25	01 21	03 11	01 16	03 55	01 34
14	C	Sol in Aries.	04 39	01 51	04 24	01 45	04 10	01 39	04 55	01 57
15	D		05 38	02 14	05 23	02 08	05 09	02 03	05 54	02 21
16	E		06 37	02 38	06 23	02 32	06 08	02 26	06 53	02 44
17	F		07 36	03 01	07 22	02 55	07 08	02 50	07 52	03 08
18	G	Sun r. 5. 45	08 35	03 25	08 21	03 18	08 07	03 13	08 52	03 31
19	A		09 35	03 48	09 20	03 42	09 06	03 36	09 51	03 54
20	B		10 34	04 11	10 19	04 05	10 05	04 00	10 50	04 17
21	C	Last but two	11 33	04 34	11 18	04 29	11 04	04 23	11 49	04 41
22	D	in gr. Bears	12 32	04 57	12 17	04 52	12 03	04 46	12 48	05 04
23	E	Tail.	13 31	05 20	13 16	05 15	13 02	05 09	13 47	05 27
24	F		14 30	05 43	14 15	05 38	14 01	05 32	14 46	05 49
25	G	An. Mary.	15 29	06 06	15 14	06 01	15 00	05 55	15 45	06 12
26	A	Sun r. 5. 38	16 27	06 29	16 13	06 23	15 59	06 18	16 43	06 35
27	B		17 26	06 51	17 12	07 46	16 58	06 40	17 42	06 57
28	C		18 25	07 14	18 11	07 08	17 57	07 03	18 41	07 20
29	D	Virg. Spike	19 24	07 36	19 10	07 31	18 55	07 25	19 40	07 42
30	E	Last but one	20 23	07 58	20 08	07 53	19 54	07 48	20 39	08 04
		in gr. Bears								
31	F	Tail.	21 21	08 21	21 07	08 15	20 53	08 10	21 37	08 26

Month days.	Week days.	Remarkable days, & fouthing of stars at midnight.	First Year.		Second Year.		Third Year.		Leap-Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			⊙pla.	⊙dec.	⊙pla.	⊙dec.	⊙pla.	⊙dec.	⊙pal.	⊙dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			γ.	North.	γ.	North.	γ.	North.	γ.	North.
1	G	Sun r.5.15	22 20	08 43	22 06	08 37	21 52	08 32	22 36	08 48
2	A		23 19	09 05	23 04	08 59	22 50	08 54	23 35	09 10
3	B		24 17	09 26	24 03	09 21	23 49	09 15	24 33	09 32
4	C	Left in great Bear's Tail.	25 16	09 47	25 02	09 42	24 47	09 37	25 32	09 53
5	D		26 14	10 09	26 00	10 03	25 46	09 59	26 30	10 14
6	E		27 13	10 30	26 59	10 25	26 44	10 20	27 29	10 35
7	F		28 11	11 51	27 57	10 46	27 43	10 41	28 27	10 56
8	G		29 10	11 12	28 56	11 07	28 41	11 02	29 26	11 17
9	A	Sun r.5.11	0. 08	11 32	29 54	11 27	29 40	11 22	0. 24	11 38
10	B	Sol in Taurus	01 07	11 53	0. 52	11 48	0. 38	11 43	01 23	11 58
11	C	Dragons tail.	02 05	12 13	01 51	12 08	01 37	12 03	02 21	12 19
12	D	Arctur's.	03 03	12 33	02 49	12 28	02 35	12 23	03 19	12 38
13	E		04 02	12 53	03 47	12 48	03 33	12 43	04 17	12 58
14	F		05 00	13 13	04 46	13 08	04 32	13 03	05 16	13 18
15	G		05 58	13 32	05 44	13 27	05 30	13 23	06 14	13 37
16	A		06 56	13 51	06 42	13 47	06 28	13 42	07 12	13 56
17	B		07 55	14 10	07 40	14 06	07 26	14 01	08 10	14 15
18	C		08 53	14 29	08 39	14 24	08 24	14 20	09 09	14 34
19	D	Sun r.4.45	09 51	14 47	09 37	14 43	09 23	14 39	10 07	14 52
20	E	Southernmost Scale of Lib.	10 49	15 06	10 35	15 01	10 21	14 57	11 05	15 11
21	F		11 47	15 24	11 33	15 19	11 19	15 15	12 03	15 28
22	G		12 45	15 42	12 31	15 37	12 17	15 33	13 01	15 46
23	A		13 43	15 59	13 29	15 55	13 15	15 51	13 59	16 04
24	B		14 41	16 16	14 27	16 12	14 13	16 08	14 57	16 21
25	C	Mark Ev.	15 39	16 33	15 25	16 19	15 11	16 25	15 55	16 38
26	D	Upper of the two formost	16 37	16 50	16 23	16 46	16 09	16 42	16 53	16 54
27	E	Sun r.4.30	17 35	17 06	17 20	17 02	17 07	16 58	17 51	17 11
28	F	in □ of the little Bear.	18 33	17 23	18 19	17 19	18 05	17 15	18 48	17 27
29	G	northernmost Scale in Lib.	19 30	17 38	19 16	17 35	19 02	17 31	19 46	17 43
30	A		20 28	17 54	20 14	17 50	19 00	17 46	20 44	17 58

Month days.	Week days.	Remarkable days, & something of stars at midnight.	First Year.		Second Year.		Third Year.		Leap Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			♂.	North.	♂.	North.	♂.	North.	♂.	North.
1	B	<i>Phil. & Jac.</i>	21 26	18 09	21 12	18 06	20 58	18 02	21 42	18 13
2	C		22 24	18 24	22 10	18 21	21 56	18 17	22 40	18 28
3	D	Brightest in the Crown.	23 22	18 39	23 08	18 35	22 54	18 32	23 37	18 43
4	E	Brightest in Serp. Neck.	24 19	18 53	24 05	18 50	23 51	18 46	24 35	18 57
5	F		25 17	19 07	25 03	19 04	24 49	19 01	25 35	19 11
6	G	Sun r. 4. 15.	26 15	19 21	26 01	19 18	25 47	19 14	26 30	19 24
7	A		27 12	19 34	26 58	19 31	26 44	19 28	27 28	19 38
8	B		28 10	19 47	27 56	19 44	27 42	19 41	28 26	19 51
9	C	Scorpion's Forehead.	29 08	20 00	28 54	19 57	28 40	19 54	29 23	20 03
10	D		II. 05	20 12	29 51	20 10	29 37	20 06	II. 21	20 16
11	E	<i>Sol in Gemini.</i>	01 03	20 25	II. 49	20 22	II. 35	20 18	01 19	20 28
12	F		02 00	20 36	01 46	20 33	01 32	20 30	02 16	20 39
13	G		02 58	20 48	02 44	20 45	02 30	20 42	03 14	20 50
14	A	Scorpion's Heart.	03 55	20 59	03 42	20 56	03 28	20 53	04 11	21 01
15	B		04 53	21 09	04 39	21 07	04 25	21 04	05 09	21 12
16	C		05 50	21 19	05 37	21 17	05 23	21 14	06 06	21 22
17	D		06 48	21 29	06 34	21 27	06 20	21 24	07 04	21 32
18	E	Sun r. 4.	07 45	21 39	07 31	21 36	07 17	21 34	08 01	21 41
19	F		08 43	21 48	08 29	21 45	08 15	21 43	08 59	21 50
20	G		09 40	21 57	09 26	21 54	09 12	21 52	09 56	21 59
21	A		10 38	22 05	10 24	22 03	10 10	22 01	10 53	22 07
22	B		11 35	22 13	11 21	22 11	11 07	22 09	11 51	22 15
23	C		12 32	22 21	12 18	22 19	12 05	22 17	12 48	22 23
24	D		13 30	22 28	13 16	22 26	13 02	22 24	13 45	22 30
25	E		14 27	22 35	14 13	22 33	13 59	22 31	14 43	22 36
26	F		15 24	22 41	15 11	22 40	14 57	22 38	15 40	22 43
27	G		16 22	22 47	16 08	22 46	15 54	22 44	16 37	22 49
28	A		17 19	22 53	17 05	22 51	16 51	22 50	17 35	22 54
29	B	<i>K. Charles II.</i>	18 16	22 58	18 02	22 57	17 49	22 55	18 32	22 58
30	C	<i>Nat. & Rest.</i>	19 13	23 03	19 00	23 02	18 46	23 00	19 29	23 00
31	D	Sun r. 3. 50.	20 10	23 07	19 57	23 06	19 43	23 05	20 27	23 08

June hath XXX days.

45

Month days.	Week days.	Remarkable days, & touching of stars at midnight.	First Year.		Second Year.		Third Year.		Leap Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			II.	North	II.	North	II.	North	II.	North
1	E		21 08	23 11	20 54	23 10	20 40	23 09	21 24	23 12
2	F		22 05	23 15	21 51	23 14	21 38	23 13	22 21	23 16
3	G		23 03	23 18	22 49	23 17	22 35	23 17	23 18	23 19
4	A		24 00	23 21	23 46	23 20	23 32	23 20	24 10	23 22
5			24 57	23 23	24 43	23 23	24 29	23 22	25 13	23 24
6			25 54	23 25	25 41	23 25	25 27	23 24	26 10	23 26
7	D		26 52	23 27	26 38	23 26	26 24	23 26	27 07	23 27
8	E		27 49	23 28	27 35	23 28	27 21	23 27	28 04	23 28
9	F		28 46	23 29	28 32	23 29	28 18	23 28	29 02	23 29
10	G	Sunr. 3.48	29 43	23 29	29 29	23 29	29 16	23 29	29 59	23 29
11	A	Sol in Cancer.	☉. 40	23 29	☉. 27	23 29	☉. 13	23 29	☉. 56	23 29
12	B		01 38	23 29	01 23	23 29	01 10	23 29	01 53	23 28
13	C		02 35	23 28	02 21	23 28	02 07	23 28	02 50	23 27
14	D		03 32	23 27	03 18	23 27	03 04	23 27	03 47	23 26
15	E		04 29	23 25	04 15	23 25	04 02	23 25	04 45	23 24
16	F		05 26	23 23	05 13	23 23	04 59	23 23	05 42	23 22
17	G	Brightest in the Harp.	06 24	23 20	06 10	23 21	05 56	23 21	06 39	23 19
18	A		07 21	23 17	07 07	23 18	06 55	23 18	07 36	23 16
19	B		08 18	23 14	08 04	23 14	07 50	23 15	08 34	23 12
20	C		09 15	23 10	09 01	23 11	08 47	23 12	09 31	23 09
21	D	Sunr. 3.50	10 12	23 06	09 58	23 07	09 45	23 08	10 28	23 04
22	E		11 09	23 01	10 56	23 02	10 41	23 03	11 25	23 59
23	F		12 07	22 56	11 53	22 57	11 39	22 58	12 22	22 54
24	G	John Bapt.	13 04	22 51	12 50	22 52	12 36	22 53	13 20	22 49
25	A		14 01	22 45	13 47	22 46	13 33	22 48	14 17	22 43
26	B		14 58	22 39	14 44	22 40	14 31	22 42	15 14	22 37
27	C		15 55	22 32	15 42	22 34	15 28	22 35	16 11	22 30
28	D		16 52	22 25	16 39	22 27	16 25	22 28	17 08	22 23
29	E	Peter Ap.	17 50	22 18	17 36	22 20	17 22	22 2	18 05	22 16
30	F		18 47	22 10	18 33	22 12	18 19	22 1	19 03	22 08

July hath XXX days.

Month days.	Week days.	Remarkable days, & southing of stars at midnight.	First Year.		Second Year.		Third Year.		Leap-Year.									
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.								
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.								
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.								
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.								
			☉.	North.	☉.	North.	☉.	North.	☉.	North.								
1	G	Sun r. 4. 2. Brightest between the Eagles shoulders.	19	44	22	02	19	30	22	04	19	17	22	05	20	00	21	59
2	A		20	42	21	53	20	28	21	55	20	14	21	57	20	57	21	51
3	B		21	39	21	44	21	25	21	46	21	11	21	49	21	54	21	42
4	C		22	36	21	35	22	22	21	37	22	08	21	40	22	51	21	32
5	D		23	33	21	25	23	19	21	28	23	05	21	30	23	49	21	23
6	E		24	31	21	15	24	17	21	18	24	03	21	20	24	46	21	13
7	F		25	28	20	05	25	14	21	08	25	00	21	10	25	43	21	02
8	G		26	25	20	54	26	11	20	57	25	57	21	00	26	41	20	51
9	A	Sol in Leo.	27	22	20	43	27	08	20	46	26	55	20	49	27	38	20	40
10	B		28	20	20	33	28	06	20	35	27	52	20	38	28	35	20	29
11	C		29	17	20	20	29	03	20	23	28	49	20	26	29	33	20	17
12	D		☉.	14	20	08	☉.	00	20	11	29	46	20	14	☉.	30	20	05
13	E		01	11	19	56	00	58	19	59	☉.	44	20	02	01	27	19	53
14	F	Sun r. 4. 15. Swans Tail. Dog Days begin.	02	09	19	44	01	55	19	46	01	41	19	49	02	25	19	39
15	G		03	06	19	30	02	52	19	33	02	38	19	36	03	22	19	26
16	A		04	04	19	17	03	50	19	20	03	36	19	23	04	19	19	13
17	B		05	01	19	04	04	47	19	06	04	33	19	09	05	17	18	59
18	C		05	58	18	49	05	45	18	52	05	31	18	57	06	14	18	45
19	D	James Ap. Sun r. 4. 30.	06	56	18	34	06	42	18	38	06	28	18	41	07	12	18	30
20	E		07	53	18	20	07	39	18	23	07	25	18	27	08	09	18	16
21	F		08	51	18	05	08	37	18	08	08	23	18	12	09	06	18	01
22	G		09	48	17	50	09	35	17	53	09	20	17	57	10	04	17	45
23	A		10	46	17	34	10	32	17	38	10	18	17	42	11	01	17	30
24	B		11	43	17	18	11	29	17	22	11	15	17	26	11	59	17	14
25	C		12	41	17	02	12	27	17	06	12	13	17	10	12	56	16	58
26	D		13	38	16	46	13	24	16	50	13	10	16	54	13	54	16	41
27	E		14	36	16	29	14	22	16	33	14	08	16	37	14	52	16	24
28	F		15	33	16	12	15	19	16	16	15	06	16	20	15	49	16	07
29	G		16	31	15	55	16	17	15	59	16	03	16	03	16	47	15	50
30	A		17	29	15	38	17	15	15	42	17	01	15	46	17	44	15	33
31	B		18	26	15	20	18	12	15	24	17	58	15	28	18	42	15	15

August hath XXXI Days.

47

Month days.	Week days.	Remarkable days, & southing of stars at midnight.	First Year.		Second Year.		Third Year.		Leap-Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			℞.	North	℞.	North	℞.	North	℞.	North.
1	C		19 24	15 02	19 10	15 06	18 56	15 11	19 40	14 57
2	D		20 22	14 44	20 08	14 48	19 53	14 53	20 37	14 39
3	E	Sun r. 4. 45	21 19	14 25	21 05	14 30	20 51	14 34	21 35	14 20
4	F		22 17	14 07	22 03	14 11	21 49	14 16	22 33	14 01
5	G		23 15	13 48	23 01	13 52	22 47	13 57	23 31	13 42
6	A		24 13	13 29	23 59	13 33	23 45	13 38	24 28	13 23
7	B		25 10	13 09	24 56	13 14	24 42	13 19	25 26	13 04
8	C		26 08	12 50	25 54	12 54	25 40	12 59	26 24	12 44
9	D		27 06	12 30	26 52	12 35	26 38	12 40	27 22	12 24
10	E		28 04	12 10	27 50	12 15	27 36	12 20	28 20	12 04
11	F		29 02	11 50	28 48	11 55	28 34	12 00	29 18	11 44
12	G		☿ 00	11 30	29 46	11 35	29 32	11 40	☿. 16	11 24
13	A	Sol in Virgo.	00 58	11 09	☿. 44	11 14	☿. 30	11 19	01 14	11 04
14	B		01 56	10 48	01 42	10 53	01 28	10 59	02 12	10 43
15	C		02 54	10 28	02 39	10 33	02 26	10 38	03 10	10 22
16	D		03 52	10 17	03 37	10 12	03 24	10 17	04 08	10 01
17	E		04 50	09 43	04 35	09 51	04 22	09 56	05 06	09 40
18	F		05 48	09 24	05 34	09 29	05 20	09 35	06 04	09 18
19	G		06 46	09 03	06 32	09 08	06 18	09 13	07 02	08 57
20	A		07 44	08 41	07 30	08 46	07 16	08 52	08 00	08 35
21	B	Fomelhaur.	08 42	08 19	08 28	08 25	08 14	08 30	08 58	08 13
22	C		09 40	07 57	09 27	08 03	09 12	08 08	09 57	07 52
23	D		10 39	07 35	10 25	07 41	10 11	07 46	10 55	07 29
24	E	Barthol. A.	11 37	07 13	11 23	07 19	11 09	07 24	11 53	07 07
25	F	First in Pegasus Wing.	12 35	06 51	12 21	06 56	12 07	07 02	12 51	06 45
26	G	and beginn.	13 34	06 28	13 20	06 34	13 06	06 40	13 50	06 23
27	A	of his Leg.	14 32	06 06	14 18	06 12	14 04	06 17	14 48	06 00
28	B	Dog days end.	15 31	05 43	15 16	05 49	15 02	05 55	15 46	05 37
29	C	Sun r. 5. 30	16 29	05 21	16 15	05 26	16 01	05 32	16 45	05 15
30	D		17 27	04 58	17 13	05 04	16 59	05 09	17 43	04 52
31	E		18 26	04 35	18 12	04 41	17 58	04 46	18 42	04 29

September hath XXX Days.

Month days.	Week days.	Remarkable days, & southing of stars at Midnight.	First Year.		Second Year.		Third Year.		Leap Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ dec.	☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			☿.	South.	☿.	North.	☿.	North.	☿.	North.
1	F		19 24	04 12	19 10	04 18	18 56	04 23	19 40	04 06
2	G	Lon. burnt 66	20 23	03 49	20 08	03 55	19 55	04 00	20 39	03 43
3	A		21 22	03 26	21 07	03 32	20 53	03 57	21 38	03 20
4	B		22 20	03 03	22 06	03 08	21 52	03 14	22 36	02 57
5	C	Sun. r. 5. 45.	23 19	02 40	23 05	02 45	22 50	02 51	23 35	02 23
6	D		24 18	02 16	24 03	02 22	23 49	02 28	24 34	02 10
7	E		25 16	01 53	25 02	01 59	24 48	02 04	25 32	01 47
8	F		26 15	01 30	26 01	01 35	25 47	01 41	26 31	01 23
9	G		27 14	01 06	26 59	01 12	26 45	01 18	27 30	01 00
10	A	Andromeda's	28 13	00 43	27 58	00 48	27 44	00 54	28 29	00 36
11	B	Head.	29 11	00 19	28 57	00 25	28 43	00 31	29 27	00 13
12	C	Sun r. 6. 0.	☿. 10	S. 04	29 56	00 02	29 41	00 07	☿. 26	Sou 10
13	D	Sol in Libra.	01 09	00 27	☿. 55	S. 22	☿. 41	Sou 16	01 25	00 34
14	E	End of Pegasus Wing.	02 08	00 51	01 54	00 45	01 40	00 39	02 24	00 57
15	F		03 07	01 14	02 51	01 09	02 39	01 03	03 23	01 21
16	G		04 06	01 38	03 52	01 32	03 38	01 26	04 22	01 44
17	A		05 05	02 01	04 51	01 56	04 37	01 50	05 21	02 08
18	B		06 04	02 25	05 50	02 19	05 36	02 13	06 20	02 31
19	C		07 03	02 48	06 49	02 42	06 35	02 37	07 20	02 55
20	D	Sun r. 6. 15.	08 03	03 12	07 48	03 06	07 34	03 00	08 19	03 18
21	E	Matth. Ev.	09 02	03 36	08 47	03 29	08 33	03 24	09 18	03 41
22	F	Pole Star.	10 01	03 58	09 47	03 53	09 32	03 47	10 17	04 05
23	G		11 00	04 22	10 46	04 16	10 32	04 10	11 16	04 28
24	A		12 00	04 45	11 45	04 39	11 31	04 33	12 16	04 51
25	B	Southernmost in Andromeda's Girdle.	12 59	05 08	12 45	05 02	12 30	04 57	13 16	05 14
26	C		13 58	05 31	13 44	05 25	13 29	05 20	14 14	05 37
27	D		14 58	05 54	14 43	05 48	14 29	05 43	15 14	06 00
28	E	Sun r. 6. 30.	15 57	06 17	15 43	06 11	15 28	06 06	16 13	06 23
29	F	Mich. Arch.	16 56	06 40	16 42	06 34	16 28	06 29	17 13	06 46
30	G		17 56	07 03	17 41	06 57	17 27	06 52	18 12	07 09

Month days.	Week days.	Remarkable days, & southing of stars at midnight.	First Year.		Second Year.		Third Year.		Leap Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			☉. South.	☉. South.	☉. South.	☉. South.	☉. South.	☉. South.	☉. South.	☉. South.
1	A		18 56	07 25	18 41	07 20	18 27	07 14	19 12	07 32
2	B		19 55	07 48	19 41	07 42	19 26	07 37	20 11	07 54
3	C		20 55	08 10	20 40	08 05	20 26	08 00	21 11	08 14
4	D		21 54	08 33	21 40	08 27	21 25	08 22	22 11	08 39
5	E	Sun r. 6.45.	22 54	08 55	22 40	08 50	22 25	08 44	23 10	09 01
6	F		23 54	09 17	23 39	09 12	23 25	09 06	24 10	09 23
7	G		24 54	09 39	24 39	09 34	24 25	09 28	25 10	09 45
8	A		25 53	10 01	25 39	09 56	25 24	09 50	26 10	10 07
9	B		26 53	10 23	26 39	10 17	26 24	10 12	27 09	10 29
10	C		27 53	10 44	27 38	10 40	27 24	10 34	28 09	10 50
11	D	Andromeda's southermost Foot.	28 53	11 06	28 38	11 00	28 24	10 55	29 09	11 11
12	E		29 53	11 27	29 38	11 22	29 24	11 17	30 09	11 33
13	F	Sol in Scorp.	30 53	11 48	30 38	11 43	30 24	11 38	31 09	11 54
14	G	Sun r. 7.0.	01 53	12 09	01 38	12 03	01 24	11 59	02 09	12 14
15	A		02 53	12 29	02 38	12 24	02 23	12 19	03 09	12 35
16	B		03 53	12 50	03 38	12 45	03 23	12 40	04 09	12 55
17	C		04 53	13 10	04 38	13 05	04 24	13 00	05 09	13 16
18	D	Luke Ev.	05 53	13 30	05 38	13 25	05 24	13 21	06 09	13 36
19	E		06 53	13 40	06 38	13 45	06 24	13 40	07 09	13 55
20	F		07 53	14 10	07 39	14 05	07 24	14 00	08 09	14 15
21	G		08 53	14 29	08 39	14 24	08 24	14 20	09 10	14 34
22	A	Sun r. 7.15.	09 53	14 48	09 39	14 44	09 24	14 39	10 10	14 54
23	B		10 54	15 07	10 39	15 03	10 25	14 58	11 10	15 12
24	C		11 54	15 26	11 39	15 21	11 25	15 17	12 10	15 31
25	D		12 54	15 44	12 40	15 40	12 25	15 35	13 11	15 49
26	E	Whales Jaw.	13 55	16 03	13 40	15 58	13 25	15 54	14 11	16 07
27	F		14 55	16 20	14 40	16 16	14 26	16 12	15 11	16 25
28	G	Sim. & Jude.	15 55	16 38	15 41	16 34	15 26	16 29	16 12	16 43
29	A	Perseus.	16 56	16 55	16 41	16 51	16 27	16 47	17 12	17 00
30	B	right Side.	17 56	17 13	17 41	17 08	17 27	17 04	18 13	17 17
31	C	Sun r. 7.30.	18 57	17 29	18 42	17 25	18 27	17 21	19 13	17 34

Month days.	Week days.	Remarkable days, & southing of stars at midnight.	First Year.		Second Year.		Third Year.		Leap-Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			m.	South.	m.	South.	m.	South.	m.	South.
1	D	All Saints.	19 57	17 46	19 43	17 42	19 28	17 38	20 14	17 50
2	E		20 58	18 02	20 43	17 58	20 28	17 54	21 14	18 06
3	F		21 58	18 18	21 44	18 14	21 29	18 01	22 15	18 21
4	G	K. W. Nat.	22 59	18 33	22 44	18 29	22 30	18 26	23 15	18 37
5	A	Pow. Plot.	24 00	18 48	23 45	18 45	23 30	18 41	24 16	18 52
6	B		25 00	19 03	24 45	18 59	24 31	18 56	25 17	19 07
7	C		26 01	19 18	25 46	19 14	25 32	19 11	26 17	19 22
8	D	Sun r. 7:45	27 02	19 32	26 47	19 28	26 32	19 25	27 18	19 36
9	E		28 02	19 46	27 47	19 42	27 33	19 39	28 19	19 49
10	F		29 03	19 59	28 48	19 56	28 33	19 52	29 19	20 02
11	G	Sol in Sagit.	1. 04	20 12	29 49	20 09	29 34	20 06	1. 20	20 15
12	A		01 04	20 25	1. 50	20 22	1. 35	20 19	01 21	20 28
13	B		02 05	20 37	01 50	20 34	01 36	20 31	02 22	20 40
14	C		03 06	20 49	02 51	20 46	02 36	20 43	03 23	20 52
15	D		04 07	21 01	03 52	20 58	03 37	20 55	04 23	21 03
16	E		05 08	21 12	04 53	21 09	04 38	21 06	05 24	21 15
17	F	Bull's Eye, or Aldebaran.	06 09	21 22	05 54	21 20	05 39	21 17	06 25	21 25
18	G		07 10	21 33	06 55	21 30	06 40	21 28	07 26	21 35
19	A		08 10	21 43	07 56	21 40	07 41	21 38	08 27	21 45
20	B	Sun rise 8.	09 11	21 52	08 57	21 50	08 42	21 48	09 28	21 54
21	C		10 12	22 01	09 58	21 59	09 43	21 57	10 29	22 03
22	D		11 13	22 10	10 59	22 08	10 44	22 06	11 30	22 12
23	E		12 14	22 18	12 00	22 16	11 45	22 14	12 31	22 20
24	F		13 15	22 26	13 00	22 24	12 46	22 22	13 32	22 28
25	G	Capella, or Goat.	14 16	22 34	14 01	22 32	13 47	22 30	14 33	22 35
26	A	Orion's Left Foot.	15 17	22 41	15 02	22 39	14 48	22 37	15 34	22 42
27	B		16 18	22 47	16 03	22 45	15 49	22 44	16 35	22 48
28	C	End of Bulls Horn.	17 19	22 53	17 05	22 52	16 50	22 50	17 36	22 54
29	D		18 21	22 58	18 06	22 57	17 51	22 56	18 37	23 00
30	E	Andr. Ap.	19 22	23 03	19 07	23 02	18 52	23 01	19 38	23 05

December hath XXXI days.

51

Month days.	Week days.	Remarkable days, & southing of stars at midnight.	First Year.		Second Year.		Third Year.		Leap Year.	
			1705.	1709.	1706.	1710.	1707.	1711.	1708.	1712.
			1713.	1717.	1714.	1718.	1715.	1719.	1716.	1720.
			☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.	☉ pla.	☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			☿.	♊outh.	☿.	♊South.	☿.	♊South.	☿.	♊South.
1	F	First in Ori-	20 23	23 08	20 08	23 07	19 53	23 06	20 39	23 09
2	G	on's Belt,	21 24	23 12	21 09	23 11	20 54	23 10	21 40	23 13
3	A	Last in Ori-	22 25	23 16	22 10	23 15	21 55	23 14	22 41	23 17
4	B	on's Belt.	23 26	23 20	23 11	23 19	22 56	23 18	23 42	23 20
5	C	Orion's right	24 27	23 22	24 12	23 22	23 57	23 21	24 44	23 23
6	D	Shoulder, &	25 28	23 24	25 13	23 24	24 58	23 23	25 45	23 25
7	E	Auriga's	26 29	23 26	26 14	23 26	26 00	23 25	26 46	23 26
8	F	right should.	27 30	23 28	27 16	23 28	27 01	23 27	27 47	23 28
9	G		28 32	23 29	28 17	23 28	28 02	23 28	28 48	23 29
10	A		29 33	23 29	29 18	23 29	29 03	23 29	29 49	23 29
11	B	Sol in Capr.	vs. 34	23 29	vs. 19	23 29	vs. 04	23 29	vs. 50	23 29
12	C	Sun r. 8. 12.	01 35	23 29	01 20	23 29	01 05	23 29	01 52	23 28
13	D	Foot of the	02 36	23 27	02 21	23 28	02 07	23 28	02 53	23 27
14	E	great Dog.	03 37	23 26	03 23	23 27	03 08	23 27	03 54	23 26
15	F	Bright Foot	04 39	23 24	04 24	23 25	04 09	23 25	04 55	23 24
16	G	of Gemini.	05 40	23 22	05 25	23 22	05 10	23 23	05 56	23 21
17	A		06 41	23 19	06 26	23 19	06 11	23 20	06 57	23 18
18	B	Mouth of the	07 42	23 16	07 27	23 16	07 12	23 17	07 59	23 15
19	C	great Dog,	08 43	23 12	08 28	23 12	08 14	23 14	09 00	23 11
20	D	or Sirius.	09 45	23 08	09 30	23 09	09 15	23 10	10 01	23 06
21	E	Tho. Apost.	10 46	23 03	10 31	23 04	10 16	23 05	11 02	23 01
22	F		11 47	22 58	11 32	22 59	11 17	23 00	12 03	22 56
23	G		12 48	22 52	12 33	22 53	12 18	22 55	13 05	22 50
24	A		13 49	22 46	13 34	22 47	13 19	22 49	14 06	22 44
25	B	Nat. Christ	14 50	22 39	14 35	22 41	14 21	22 43	15 07	22 37
26	C	St. Stephen.	15 52	22 32	15 37	22 34	15 22	22 36	16 08	22 30
27	D	John Evan.	16 53	22 25	16 38	22 27	16 23	22 28	17 09	22 23
28	E	Innocents.	17 54	22 17	17 39	22 19	17 24	22 21	18 10	22 15
29	F	Castor.	18 55	22 09	18 40	22 11	18 25	22 13	19 12	22 06
30	G	Little Dog's	19 56	22 00	19 41	22 02	19 27	22 04	20 13	21 57
31	A	thigh. Pollox	20 57	21 51	20 42	21 53	20 28	21 55	21 14	21 48

A Table of the Variation of the Sun's Declination, to every 15 Degrees of Longitude from the Meridian of London.

Degrees of Longitude from the Meridian of London.

<i>Diurn. Variat.</i>	D. 15	D. 30	D. 45	D. 60	D. 75	D. 90	D. 105	D. 120	D. 135	D. 150	D. 165	12 18
min.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.
2	00	00	00	00	00	00	01	01	01	01	01	01
3	00	00	00	00	01	01	01	01	01	01	01	01
4	00	00	00	01	01	01	01	01	01	02	02	02
5	00	00	01	01	01	01	01	02	02	02	02	02
6	00	00	01	01	01	01	02	02	02	02	03	03
7	00	01	01	01	01	02	02	03	03	03	03	03
8	00	01	01	01	02	02	02	03	03	03	04	04
9	00	01	01	01	02	02	03	03	03	04	04	04
10	00	01	01	02	02	02	03	03	04	04	05	05
11	00	01	01	02	02	03	03	04	04	05	05	05
12	00	01	01	02	02	03	03	04	04	05	05	06
13	01	01	02	02	03	03	04	04	05	05	06	06
14	01	01	02	02	03	03	04	05	05	06	06	07
15	01	01	02	02	03	04	04	05	06	06	07	07
16	01	01	02	03	03	04	05	05	06	07	07	08
17	01	01	02	03	04	04	05	06	06	07	08	08
18	01	01	02	03	04	04	05	06	07	07	08	09
19	01	02	02	03	04	05	06	06	07	08	09	09
20	01	02	02	03	04	05	06	06	07	08	09	10
21	01	02	03	03	04	05	06	07	08	09	10	10
22	01	02	03	04	05	05	06	07	08	09	10	11
23	01	02	03	04	05	06	07	08	09	10	11	11
24	01	02	03	04	05	06	07	08	09	10	11	12

Expla.

IN every Page there is 11 Columns; the first shews the Days of the Month, the second the Days of the Week, expressed by the Letters A, B, C, &c. the third the Southing of several Stars at Midnight, at which time the said Stars are to be observed, thereby to find the Latitude; in the same Column is given the time of Sun-Rising (and by subtracting the time of Rising from 12 hours, the time of Setting) to every quarter of an hour's Difference; the eight following Columns shews the Sun's Place and Declination for the First, Second, Third, and Leap-year, according to their respective Titles.

For the more ready knowing of Leap-year, the following Table is inserted, where it is found by inspection, as also the First, Second, or Third Years after Leap-year.

First Year.	Second Year.	Third Year.	Leap-Year.
1705	1706	1707	1708
1709	1710	1711	1712
1713	1714	1715	1716
1717	1718	1719	1720
1721	1722	1723	1724
1725	1726	1727	1728
1729	1730	1731	1732
1733	1734	1735	1736

The Use of the Kalendar.

To find the Day of the Week or Month for any time past, or to come by the Kalendar.

First, Find the Dominical Letter for the Year; then proceed as follows.

Example 1. Suppose it were required to find what Day of the Month was the third Wednesday in *March* 1713.

Having found the Dominical Letter by the Directions in Page 21, which is D, turn to the Month of *March*, and account D for Sunday, three days downward from which is G for Wednesday, and the third Wednesday is the 18th day of *March*, as was required.

Example 2. What day of the Week will the Second of *September* be in the Year 1716?

This Year being Leap-year has two Dominical Letters, A and G, the first serving from the first of *January* to the end of *February*; the latter from thence to the Year's end.

Wherefore looking against the second of *September*, there stands G, which represents Sunday, the day of the Week required.

Note, That the *Gregorian* or *Foreign Account* begins eleven days before ours, so that our 1st of *January* is their 12th, our 12th their 23d, our 23d their 3d of *February*, our 24th of *February* is their 7th of *March*; but in Leap-year, our 24th of *February* is their 6th of *March*, because then *February* hath 29 days.

To

Expianation of the Kalendar.

To the find Sun's Place and Declination by the Kalendar.

Example 1. Suppose the Sun's Place and Declination be required on the 10th of *January* 1715, being third after Leap-Year.

In the Month of *January*, in the first Column, look the Day of the Month over against which, under the third Year, stands $\approx$ 53, that is, the Sun's Place is in 53 min. of *Aquarius*. In the next Column, under the said Year, stands 20 00, under the Title *South*, which shews the Declination to be 20 deg. 00 min. Southerly; and this serves for the Year 1715 on the said 10th of *January*, being the third after Leap-Year.

Example 2. Suppose the Sun's Place and Declination to be required on the 10th of *March*, 1716 being Leap-Year.

In the Month of *March*, in the first Column find the day of the Month; over against which, under Leap-year, stands ∇ 57, which shews the Sun's Place to be in 57 min. of *Aries*; and in the next Column, under Leap-Year stands *Nor.* 23 which shews the Declination to be 23, min. Northerly which was required.

Altho it is common to take the Declination as it is in the Kalendar, yet if the Difference of Longitude be considerable from *London*, it is requisite the Declination should be corrected, because in the Kalendar it is calculated to the Meridian of *London*; for which end the *Table of Variation of the Sun's Declination to every 15 Degrees of Longitude from the Meridian of London*, immediately following the Kalendar, is added; the Use and Explanation whereof follows.

IN the first Column is the Diurnal Variation, which is found by subtracting the Declination for the given Day of the Month, from the Declination for the day following; or contrarily this from that, that is the lesser from the greater, and the difference is the Diurnal Variation. In the head of the other Columns are Degrees of Longitude from *London* either Easterly or Westerly; and in those Columns under the respective Degrees of Longitude, are the Minutes of Declination answerable to the Diurnal Variation. As suppose the Diurnal Variation were 10 Minutes, and the Difference of Longitude 90 Degrees, against 10 in the first Column, and under 90 Degrees, at the head of the Table, stand 2 Minutes, which answer thereto, and are to be used as follows.

The Use of the Table of the Variation of the Sun's Declination, &c.

The Rule. First, If the Difference of Longitude be Westerly, and the Declination encreasing, the Variation found in this Table, must be added to the Declination found in the Kalendar; but if the Declination be decreasing it must be subtracted therefrom.

Secondly, If the Difference of Longitude be Easterly, and the Declination increasing, the Variation aforesaid must be subtracted: but the Declination decreasing, must be added.

Example 1. April the 19th 1708, being at Sea, the Difference of Longitude from the Meridian of *London*, being 90 Degrees Westerly, I find the Declination in the Kalendar to be 14 deg. 52 min. North; and the 20th day,

day, the Declination is 15 deg. 11 min. therefore subtracting the lesser Declination from the greater, the Remainder is 19 min. which is the daily increase. Then in the Table under 90 deg. and over against 19 stands 5 min. which (because the Difference of Longitude is Westerly, and the Declination increasing) must be added to 14 deg. 52 min. before found, which makes the true Declination 14 deg. 57 min. North.

If the Difference of Longitude in this case had been easterly, the 5 min. found in the Table must have been subtracted.

It is easily discerned whether the Declination increase or decrease, by observing whether the Declination for the day following be greater or lesser; for if it be greater, then it increases; but if less, then it decreases.

Examp. 2. January the 10th 1709 being at Sea, the Difference of Longitude from London being 120 deg. Westerly, I find the Declination in the Kalendar to be 19 deg. 53 min. South, and the 11th day it is 19 deg. 38 min. therefore subtracting the lesser, from the greater, the Difference is 15 min. which is the dayly decrease: Then in this Table under 120 deg. and against 15, stands 5 min. (which because the Difference of Longitude is Westerly, and the Declination decreasing) must be subtracted, which makes the true Declination 19 deg. 48 min. South. If the Difference of Longitude had been Easterly, the 5 minutes must have been added.

The Use of the Sun's Declination to find the Latitude.

The Declination of the Sun is mostly used at Sea; with the Complement of the Sun's Meridian Altitude, taken by the Quadrant, or Cross-staff, to find the Latitude of the Place: For which take the following Directions.

1. If the Sun comes to the Meridian in the South, and the Declination be North, then the Declination added to the Complement of the Altitude is the Latitude Northerly.

Examp. Suppose being at Sea, the 10th of April 1709, the Declination is found by the Table to be 11 deg. 53 min. North, the Sun comes to the Meridian in the South; the Complement of the Altitude got by Observation, is 23 deg. 10 min. What is the Latitude.

Complement of the Altitude is	23	10
Declination North added	11	53
The Latitude North	35	03

2. If the Sun comes to the Meridian in the North, and hath North Declination, then subtract the Complement of the Altitude from the Declination, the Remainder is the Latitude North. But if the Complement of the Altitude exceed the Declination, subtract the Declination therefrom, and the Remainder is the Latitude Southerly.

Examp. 1. Suppose being at Sea May the 10th 1709, the Declination being 20 deg. 12 min. North, the Sun comes to the Meridian in the North, the Complement of the Altitude by Observation is 17 deg. 23 min. What is the Latitude?

Declination

Use of the Table of Declination.

Declination North is $\text{---}20^{\circ} 12'$
 Compl. Alt. subtracted $\text{---}17^{\circ} 23'$
 The Latitude is $\text{---}02^{\circ} 49'$

Examp. 2. Suppose being at Sea, *June* the 10th, 1709, the Declination by the Table is 23 deg. 29 min. North, the Complement of the Altitude by Observation is 33 deg. 10 min. the Sun comes to the Meridian in the North: What is the Latitude?

Compl. Alt. is $\text{---}33^{\circ} 10'$
 Declinat. North subtracted $\text{---}23^{\circ} 29'$
 Latitude is $\text{---}09^{\circ} 41'$ South

3. If the Sun comes to the Meridian in the North, and hath South Declination, the Declination added to the Complement of the Altitude, is the Latitude South.

Examp. Suppose being at Sea *January* the 10th 1712; the Sun comes to the Meridian in the North, the Complement of the Altitude is 22 deg. 10 min. the Declination 20 deg. 03 min. South: What is the Latitude?

Complement of the Altitude is $\text{---}22^{\circ} 10'$
 Declination South added $\text{---}20^{\circ} 03'$
 The Latitude South $\text{---}42^{\circ} 13'$

4. If the Sun comes to the Meridian in the South, and have South Declination, subtract the Complement of the Altitude from the Declination, the Remainder is the Latitude South. But if the Complement of the Altitude exceed the Declination, subtract the Declination therefrom, the Remainder is the Latitude North.

Examp. 1. Suppose being at Sea, *January* the 1st 1712, the Sun coming to the Meridian in the South. The Complement of the Altitude is 10 deg. 36 min. the Declination 21 deg. 46 min. South: What is the Latitude?

Declination South $\text{---}21^{\circ} 46'$
 Compl. Alt. subtracted $\text{---}10^{\circ} 36'$
 Latitude South $\text{---}10^{\circ} 06'$

Examp. 2. Suppose being at Sea, *February* the 10th 1712, the Sun coming to the Meridian in the South, the Complement of the Altitude is 25 deg. 20 min. the Declination 10 deg. 47 min. South: What is the Latitude?

Compl. Alt. is $\text{---}25^{\circ} 20'$
 Declination South subtracted $\text{---}10^{\circ} 47'$
 Latitude North $\text{---}14^{\circ} 33'$

5. If the Sun be in the Zenith, (that is, right over head) if it have either North or South Declination the Declination is the Latitude Northerly or Southerly.

6. If the Sun have no Declination, the Complement of the Altitude is the Latitude, which is Northerly or Southerly, according as the Sun is to the Northward or Southward of the Equinoctial. A

A Table of the Sun's Right-Ascension.

57

Days.	Jan.		Febr.		March.		April.		May.		June.	
	☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
1	19	35	21	42	23	28	01	21	03	14	05	19
2	19	39	21	46	23	32	01	25	03	18	05	23
3	19	43	21	50	23	36	01	29	03	22	05	27
4	19	47	21	54	23	39	01	33	03	26	05	31
5	19	51	21	58	23	43	01	36	03	30	05	36
6	19	56	22	02	23	46	01	40	03	34	05	40
7	20	00	22	06	23	50	01	44	03	38	05	44
8	20	04	22	10	23	53	01	47	03	42	05	48
9	20	09	22	14	23	57	01	51	03	46	05	52
10	20	13	22	17	00	01	01	54	03	50	05	56
11	20	17	22	21	00	05	01	58	03	54	06	00
12	20	22	22	25	00	08	02	02	03	58	06	04
13	20	26	22	29	00	12	02	06	04	02	06	08
14	20	30	22	33	00	15	02	10	04	06	06	12
15	20	34	22	36	00	19	02	13	04	10	06	17
16	20	38	22	40	00	23	02	17	04	14	06	21
17	20	42	22	44	00	26	02	21	04	18	06	25
18	20	46	22	48	00	30	02	25	04	22	06	29
19	20	50	22	52	00	33	02	29	04	26	06	33
20	20	54	22	55	00	37	02	32	04	30	06	38
21	20	58	22	59	00	41	02	36	04	34	06	42
22	21	03	23	03	00	44	02	40	04	38	06	46
23	21	07	23	06	00	48	02	44	04	42	06	50
24	21	11	23	10	00	52	02	48	04	46	06	54
25	21	15	23	13	00	55	02	51	04	50	06	58
26	21	19	23	17	00	59	02	55	04	54	07	02
27	21	23	23	21	01	03	02	59	04	58	07	06
28	21	27	23	25	01	06	03	03	05	02	07	10
29	21	31			01	10	03	07	05	06	07	14
30	21	35			01	14	03	10	05	11	07	19
31	21	38			01	17			05	15		

A Table of the Sun's Right Ascension.

Days.	July.		August.		Septem.		October.		Novem.		Decem.	
	☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
1	07	23	09	25	11	19	13	08	15	07	17	15
2	07	27	09	29	11	23	13	12	15	11	17	20
3	07	31	09	33	11	26	13	15	15	15	17	25
4	07	35	09	37	11	30	13	19	15	19	17	29
5	07	39	09	40	11	33	13	22	15	23	17	34
6	07	43	09	44	11	37	13	26	15	27	17	38
7	07	47	09	48	11	41	13	30	15	31	17	42
8	07	51	09	51	11	44	13	34	15	36	17	47
9	07	55	09	55	11	48	13	38	15	40	17	51
10	07	59	09	58	11	51	13	41	15	45	17	56
11	08	03	10	02	11	55	13	45	15	49	18	00
12	08	07	10	06	11	59	13	49	15	53	18	05
13	08	11	10	10	12	02	13	53	15	58	18	09
14	08	15	10	14	12	06	13	57	16	02	18	14
15	08	19	10	17	12	09	14	00	16	07	18	19
16	08	23	10	21	12	13	14	04	16	11	18	24
17	08	27	10	25	12	17	14	08	16	15	18	28
18	08	31	10	28	12	20	14	12	16	19	18	33
19	08	35	10	32	12	24	14	16	16	23	18	37
20	08	39	10	35	12	27	14	20	16	28	18	41
21	08	43	10	39	12	31	14	24	16	32	18	45
22	08	47	10	43	12	35	14	28	16	36	18	49
23	08	51	10	46	12	38	14	32	16	40	18	54
24	08	55	10	50	12	42	14	36	16	44	18	58
25	08	58	10	53	12	45	14	39	16	49	19	03
26	09	02	10	57	12	49	14	43	16	53	19	07
27	09	06	11	01	12	53	14	47	16	57	19	11
28	09	10	11	04	12	57	14	51	17	02	19	16
29	09	14	11	08	13	01	14	55	17	06	19	20
30	09	17	11	11	13	04	14	59	17	11	19	25
31	09	21	11	15			15	03			19	30

A Table of the Fixed Stars.

59

A Table of Right Ascension and Declination of some of the most notable Fixed Stars.

Stars Names.	Magnit.	Right Ascens. H. M.	Declination. D. M.	N.or.S.
Pole Star	02	00 32	87 33	N
The upper of the two foremost of the Square in the Little Bear	02	14 51	75 36	N
The upper of the two foremost of the Square in the Great Bear	02	10 43	63 32	N
The lower of the two foremost of the Square in the Great Bear	02	10 41	58 08	N
The lower of the two latter of the Square of the Great Bear	02	11 36	55 33	N
The upper of the two latter in the Square of the Great Bear	02	11 59	58 51	N
Last but two in the Great Bear's Tail	02	12 40	57 47	N
Last but one in the same	02	13 10	56 41	N
Last in the same	02	13 34	51 00	N
The Dragon's Tail	02	13 59	65 56	N
Arcturus	01	14 01	20 58	N
Brightest in the Crown	02	15 21	27 51	N
Brightest in the Harp	01	18 26	38 30	N
Swan's Tail	02	20 30	44 05	N
Perseus's Right-side	02	02 57	48 36	N
Capella or Goat	01	04 52	45 37	N
Auriga's Right Shoulder	02	05 44	44 56	N
Brightest in the Serpents Neck	02	15 28	07 30	N
Brightest between the Eagle's Shoulders	02	19 35	08 03	N
First in Pegasus Wing, or Marchab	02	22 48	13 28	N
Brginning of Pegasus Leg	02	22 48	26 18	N
End of Pegasus Wing	02	23 57	13 22	N
Andromeda's Head	02	23 52	27 18	N
Southermost in Andromeda's Girdle	02	00 51	33 55	N
Andromeda's Southermost Foot	02	01 44	40 44	N
The Bull's Eye, or Aldebrand	01	04 17	15 48	N
End of the Bull's Horn	02	05 06	28 21	N
Castor	02	07 14	32 33	N
Pollox	02	07 25	28 46	N
Bright Foot of Gemini	02	06 19	16 38	N
Brightest in the Lion's Neck	02	10 02	21 29	N
Lion's Heart	01	09 51	13 33	N
Lion's Tail	01	11 32	16 25	N
Virgin's Spike	01	13 08	09 31	S
Southermost Scale of Libra	02	14 33	14 37	S

H 2

Norther-

Northermost Scale of <i>Libra</i>	02	14	59	08	07	S
<i>Scorpion's Forehead</i>	02	15	46	18	51	S
<i>Scorpion's Heart</i>	01	16	10	25	37	S
<i>Fomelhaut</i>	01	22	39	31	17	S
<i>Whale's Jaw</i>	02	02	45	02	48	N
<i>Orion's Right Shoulder</i>	02	05	38	07	18	N
<i>Orion's Left Shoulder</i>	02	05	08	06	01	N
<i>First in Orion's Belt</i>	02	05	15	00	35	S
<i>Middle of Orion's Belt</i>	02	05	20	01	26	S
<i>Last in Orion's Belt</i>	02	05	24	02	09	S
<i>Orion's Left Foot, or Regil</i>	01	04	59	08	37	S
<i>Mouth of the Great Dog, or Sirius</i>	01	06	31	16	14	S
<i>Right Forefoot of the great Dog</i>	02	06	09	17	49	S
<i>Little Dog's Thigh</i>	02	07	22	06	03	N
<i>Hydra's Heart</i>	01	09	12	07	15	S

The Explanation and Use of the TABLE of the Sun's Right Ascension ;
and of the Table of the Star's Right Ascension and Declination.

IN the Table of the Sun's Right Ascension, the first Page contains the first six Months of the Year, the next Page the other six Months. At the head of the Table are the Months ; in the first Column towards the left hand are the Days of the Month, and in the opposite Columns is the Right Ascension in Hours and Minutes.

In the Table of the Stars Right Ascension and Declination, there are five Columns ; in the first towards the left hand, are the Names of the Stars ; in the second, the Stars Magnitude ; in the third, their Right Ascension in Hours and Minutes ; in the fourth their Declination in Degrees and Minutes ; the last shews whether the Declination be North or South.

First, To find the time of the Star's coming upon the Meridian.

The Rule. Look the Right Ascension of the Sun and Star ; subtract the Right Ascension of the Sun from the Right Ascension of the Star ; but if the Star's Right Ascension be less than the Sun's add thereto 24 hours, and then subtract ; the Remainder after Subtraction, is the time of the Star's coming upon the Meridian from Noon : But if the Remainder exceed 12 hours subtract 12 hours therefrom, and then the Remainder is the time from Midnight.

Examp. 1. Suppose the time that *Fomelhaut* comes upon the Meridian on the 10th of October, were required.

I find in the Table the Star's Right Ascension to be 22 hours 39 min. and the Sun's to be 13 hours 41 min. which subtracted from the Star's Right Ascension, leaves 8 hours 58 min. the time of the Star's coming upon the Meridian, Afternoon.

Examp. 2. Suppose the time that the *Whale's Jaw* comes upon the Meridian on the 15th of October, was required.

I find the Star's Right Ascension to be 2 hours 45 min. the Sun's 14 hours : Now because the Sun's Right Ascension is more than the Star's, add

to the Star's Right Ascension 24 hours, which makes 26 hours 45 min. from which subtracting the Sun's Right Ascension, there remain 12 hours 45 min. from which subtracting 12 hours, there remains 45 min. which is the time of the Star's southing after Midnight, which was required.

Secondly, The time being given, to find what Star will come to the Meridian about the same time.

The Rule. To the Sun's Right Ascension, add the time from Noon, at which the Star's coming to the Meridian is desired: The Sum is the Right Ascension of the Star that will come to the Meridian at that time; with which enter the Table of the Star's Right Ascension and Declination, where look what Star's Right Ascension agrees with the Right Ascension before found, or nearest thereto, and that is the Star sought for

Example. Suppose March the 27th, I desire to know what Star will come upon the Meridian at 4 hours after Midnight.

The Sun's Right Ascension is 1 hour 3 minutes; the time from Noon is 16 hours; which added to the Sun's Right Ascension, makes 17 hours 3 minutes. The nearest in the Table are, the *Scorpion's Heart*, whose Right Ascension is 16 hours 10 min. and comes to the Meridian 53 min. before 4, and the *Brightest in the Harp*, whose Right Ascension is 18 hours 26 min. and therefore comes to the Meridian 1 hour 23 min. after 4, or at 5 hours 23 min.

Directions for Observations of the Stars, to find the Latitude of the Place.

Having before shewn how to find the time of a Star's coming to the Meridian, I shall now shew how by the Star's Altitude to find the Latitude.

Note; In North Latitude, those Star's whose North Declination exceeds the Complement of the Latitude, may be observed under the Pole. And the same may be performed by the Southern Stars in South Latitude.

Directions for finding the Latitude, by the Merid. Alt. of the Fixed Stars.

Rule 1. If the Star comes to the Meridian in the South, and have North Declination, the Complement of the Altitude (got by Observation) added to the Declination of the Star (found in the Table of the Star's Right Ascension and Declination) gives the Latitude North.

Example On the 10th of June being at Sea, I find by the foregoing Directions, that the *brightest Star between the Eagle's Shoulder*, comes to the Meridian in the South at 1 hour 39 min. after Midnight, the Meridional Altitude whereof by Observation is 63 deg. which subtracted from 90 deg. there remains 27 deg. the Complement of the Altitude; to which adding 8 deg. 3 min. the Declination of the Star North, gives 35 deg. 3 min. the Latitude of the Place North, which was required.

Rule 2. If a Star comes to the Meridian in the South, and have South Declination, subtract the Declination from the Complement of the Altitude, and the Remainder is the Latitude North: But if the Declination exceed the Complement of the Altitude, subtract the Complement of the Altitude therefrom, and the Remainder is the Latitude South.

Examp.

Examp. 1. Suppose on the 10th of July, being at Sea, the Star *Fomalhaut* coming to the Meridian in South, at 2 hours 40 min. after Midnight, the Meridional Alt. is 35 deg. 50 min. the Compl. whereof is 54 deg. 10 min. the Star's Declination is 31 deg. 17 min. South; which subtracted from the Compl. of Alt. leaves 22 deg. 53 min. the Latitude North.

Examp. 2. Suppose on the 20th of June, being at Sea, the *Scorpions Heart* comes to the Meridian in the South at 9 hours 32 min. at Night, the Complement of the Altitude is 5 deg. 27 min. the Declination 25 deg. 37 min. South; from which subtracting the Compl. of the Altitude, there remains 20 deg. 10 min. which is the Latitude South.

Rule 3. If a Star come to the Meridian in the North, and have North Declination, subtract the Declination from the Compl. of the Altitude, the Remainder is the Lat. South. But if the Declination exceed the Compl. of the Altitude, subtract the Compl. of the Altitude therefrom, the Remainder is the Latitude North.

Examp. 1. On the 11th of June, the *Brightest in the Harp* comes to the Meridian in the North at 26 min. after Midnight, the Compl. of the Altitude is 79 deg. from which subtracting the Declination, which is 38 deg. 30 min. North, there remains 40 deg. 30 min. which is the Lat. South.

Examp. 2. On the 8th of September, *Andromeda's Head* comes to the Meridian in the North at 8 min. after Midnight; the Complement of the Altitude is 7 deg. 10 min. which subtracted from the Declination 27 deg. 18 min. gives 20 deg. 8 min. which is the Lat. North.

Rule 4. If a Star come to the Meridian in the North, and have South Declination, the Complement of the Altitude added to the Declination, gives the Latitude South.

Examp. On the 12th of December, *Syrius* (or the *Great Dog's Mouth*) comes to the Meridian in the North at 26 min. after Midnight, the Compl. of the Alt. is 30 deg. to which adding 16 deg. 14 min. the Declination South, gives 46 deg. 14 min. the Latit. South.

Rule 5. If a Star come to the Meridian under the Pole, then add the Complement of the Declination to the Meridian Altitude, and the Sum is the Latitude either North or South, according to the Star's Declination.

Examp. On the 10th of March, the *Pole-Star* comes to the Meridian under the Pole at 31 min. after Midnight, the Meridian Altitude 44 deg. 30 min. the Complement of the Declination 2 deg. 27 min. which added together, gives 46 deg. 57 min. which is the Latitude North.

Rule 6. If the Star be in the Zenith, the Declination is the Latitude either North or South, according to the Declination of the Star.

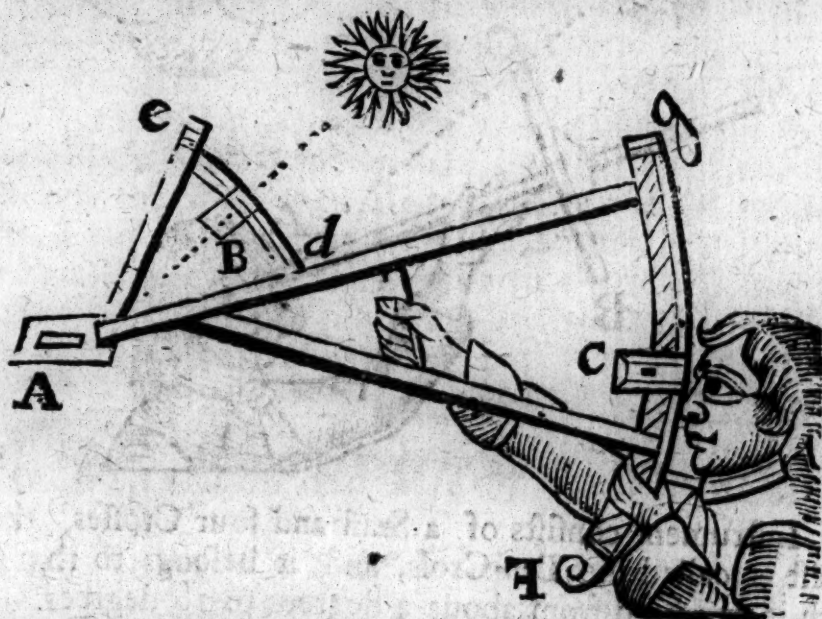
Rule 7. If the Star have no Declination, the Compl. of the Merid. Alt. is the Lat. of the Place either North or South, according as the Star is either to the Northward or Southward.

The Description and Use of the Sea-Quadrant.

THIS Instrument consists of three Vanes and two Arches; the Horizon-Vane, which in observing, respects the Horizon, as at A. The Shadow

The Use of the Quadrant, Forestaff and Nocturnal. 63

dow-Vane, so called, because of its giving the Shadow upon the Horizon-Vane in time of Observation, as at B. Lastly, the Sight-Vane, which in time of Observation is placed at the Eye, through which the Shadow and Horizon are seen, as at C. The lesser of the Arches, marked with *d e*, is called the Sixty-Arch, because it contains sixty *Degrees*. In time of Observation the Shadow-Vane is placed upon this Arch always to an even *Degree*; it is numbred from the upper end and downward with 5, 10, 15, 20, &c. The bigger Arch marked with *g F*, is called the Thirty-Arch, because it contains 30 *Degrees*; it is divided into *Degrees* and *Minutes*.



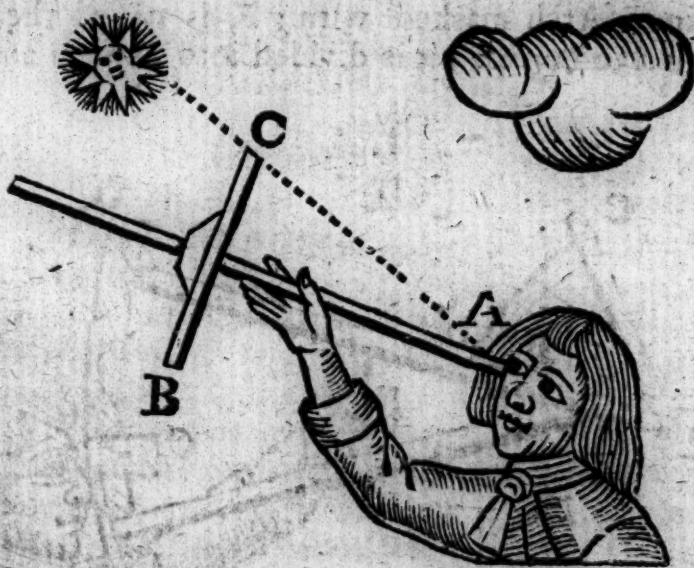
The Use of this Instrument, is to take the Sun's Meridian Altitude which is done in the manner following.

Put the Horizon-Vane upon the end of the Quadrant at A, the Shadow-Vane upon the Sixty (or lesser) Arch, to a number of *Degrees* less than the Complement of the Altitude by 15 or 20 *Degrees*, and the Sight Vane upon the 30 Arch. The Vanes being thus fixed upon the Quadrant, the back being turned towards the Sun, and the Sight-Vane placed to the Eye, look through the said Sight-Vane, and cause the shadow of the upper edge of the Shadow-Vane, to fall upon the upper part of the slit in the Horizon-Vane, where usually (for perspicuity sake) there is drawn a black Line; and if at the same time the Horizon appear through the said slit in the Horizon-Vane, that is the Sun's present Altitude; but if the Sea appear instead of the Horizon, then slide the Sight-Vane lower towards F; if the Sky appear instead of the Horizon, then slide the Sight-Vane a little higher, until the Horizon appear through the Horizon-Vane. But to obtain the Meridian Altitude (which is the greatest Altitude the Sun will have that day, and is the thing used to find the Latitude) continue observing, and as the Sun rises, the Sea will appear through the Horizon-Vane; then must the Sight-Vane be removed lower: and thus continue observing as often as may be convenient, till the Sun be at the highest, which is the Meridian Altitude. When the Sun begins to fall, the Sky will appear instead of the Horizon, and

64 The Use of the Quadrant, Forestaff and Nocturnal.

and then it's time to give over observing for that day. Having thus done, add the *Degrees* upon the sixty Arch, to the *Degrees* and *Minutes* upon the Thirty-Arch, and the Sum is the Complement of the Meridian Altitude; the Use of which, for finding the Latitude, is sufficiently shewn in the preceding Rules.

The Description and Use of the Cross-staff or Fore-staff.



THIS Instrument consists of a Staff and four Crosses, the first and shortest is called the Ten-Cross, and it belongs to that side of the Staff which is numbred from about 3 degrees to 10 degrees. Sometime the Thirty-Cross and the rest of the Crosses are so made, as that the breadth thereof serves instead of this Ten-Cross.

The second Cross is called the Thirty-Cross, and belongs to that side of the Staff which is numbred from about 10 degrees to 30.

The third Cross is called the Sixty-Cross, and belongs to that side of the Staff which is numbred from about 20 to 60 degrees.

The fourth and last Cross is called the Ninety-Cross, and belongs to the side of the Staff which is numbred from about 30 to 90 degrees.

This Staff is likewise numbred with the Complement to 90 degrees (*viz.*) at 10 stands 80, at 20 stands 70, at 30 stands 60, and so of the rest.

The Use of this Instrument is to take the Meridian Altitude of the Sun or Stars, which is done as followeth.

First; Consider what the Sun's greatest Altitude will be that Day, and accordingly use the Cross most suitable; (*viz.*) If the Meridian Altitude be judged to be under 10 degrees, use the Ten-Cross; if between 10 and 30, the Thirty-Cross; if between 30 and 60, the Sixty-Cross; if between 60 and 90, the Ninety-Cross, which is seldom used.

Having put on the Cross, place the flat end of the Staff at A, to the outside of the Eye, as near as may be, without hindring the sight: thus the Face being toward the Sun or Star, hold the Cross upright; then look at the

The Description and Use of the Fore-Staff. 265

the upper end of the Cross at C for the Sun or Star, and at the lower end at B for the Horizon, and if the Sea appear instead of the Horizon, remove the Cross a little further from the Eye; but if the Sky appear instead of the Horizon, remove the Cross a little nearer to the Eye, until the Sun or Star appear at the upper end, and the Horizon at the lower end; which when they do, then upon the side of the Staff belonging to the Cross used in Observation, will be found the Degrees and Minutes of the Altitude of the Sun or Star. But the greatest Altitude being that which is required, Observation must be continued as frequently as Judgment shall direct, until the Sun or Star be at the highest; and as the Sun or Star rises, the Sky will appear instead of the Horizon; but when the Sun or Star is past the Meridian, and begins to fall, the Sea will appear instead of the Horizon, and then is the Observation finished; and upon the side of the Staff, proper to the Cross used, are found the Degrees and Minutes of the Sun's Meridian Altitude; which subtracted from 90 Degrees, gives the Complement of the Altitude; or it may be taken off the Staff at once (the Staff being numbred with the Complement, as is shewed before) with which to proceed in finding the Altitude of the Place, observe the Rules and Directions foregoing.

The Description and Use of the Nocturnal.

IT consists of three parts. The first and unmoveable part, on which is the handle, by which to hold it in time of Observation; upon the fore-side of which, in the outermost Circle, are the days of the Month, and upon the innermost are set off the 24 hours, and upon the back-side are the 32 Points of the Compass.

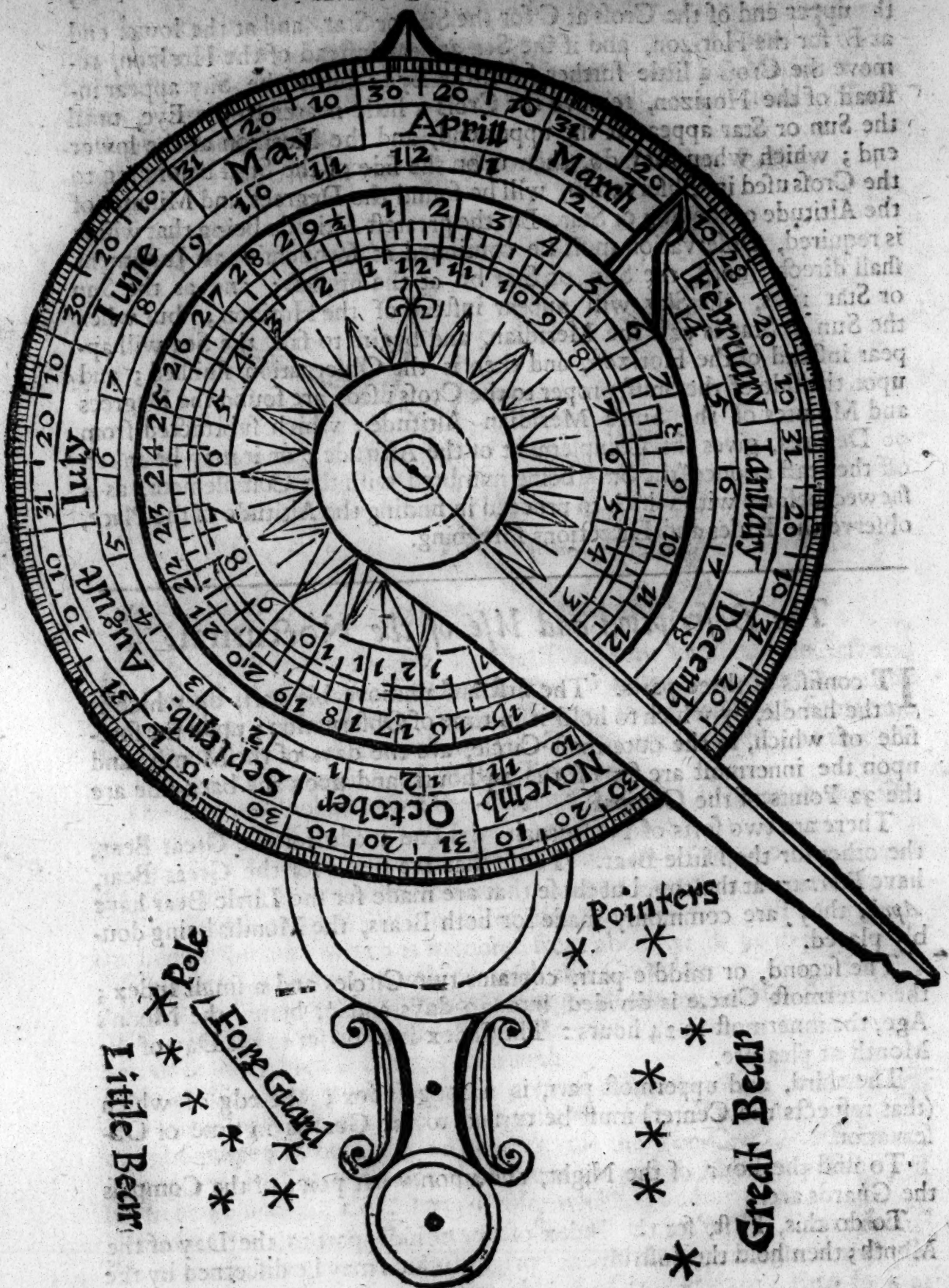
There are two sorts of Nocturnals, the one made for the Great Bear, the other for the Little Bear. Those that are made for the Great Bear, have *February* at the top, but those that are made for the Little Bear have *April*, they are commonly made for both Bears, the Months being doubly placed.

The second, or middle part, contains two Circles and a small Index; the outermost Circle is divided into 29 days and $\frac{1}{2}$, being the Moon's Age, the innermost in 24 hours: The Index is to be set to the Day of the Month at pleasure.

The third, and uppermost part, is a long Index; the edge of which (that respects the Center) must be turned to the Guards in time of Observation.

To find the hour of the Night, and upon what point of the Compass the Guards are.

To do this, First, set the Index of the middle part to the Day of the Month; then hold the Instrument upright, which may be discerned by the



tip on the top of the Nocturnal; then look through the hole in the middle of the Nocturnal for the North Star: which having found, turn the edge of the long Index to the Guards (for which the Nocturnal was made either for the Little or Great Bear, then shall the edge of the Index (upon the innermost Circle of the middle part) give the hour of the Night; and at the same time on the back-side of the Nocturnal, is the Point of the Compass on which the Guards are. Note, the hour found hereby is uncertain.

But if the Practitioner intends to be more certain in the time of the Night, let him take the Altitude of some known Star, and proceed according to the Directions given in the *Tenth Astronomical Problem* following.

To find the Moon's Southing, and time of Full Sea, by the Nocturnal.

To do this, It is but looking upon the Middle piece of the Nocturnal and in the outermost Circle find the Moon's Age; and opposite to it, in the innermost Circle of the same piece, stands the Southing.

Example Suppose the Moon 25 Days old, and the time of her Southing required.

Look for 25, the Moon's Age, in the outermost Circle opposite to which in the innermost Circle, stands 8, which is the Moon's Southing at 25 days old required.

Note; That always between the Change and Full, the Moon comes to South in the Evening, but after the Full in the Morning.

Thus having found the Moon's South, add thereto the time of Flowing upon the Full and Change-days at any place, and that gives the time of Full-sea when required. But this hath been sufficiently shewed in another place therefore needs no Example.

The Use of the following Table of the Declination of the North-Star.

THE Use of the Table is this: Having taken the Altitude of the Pole-Star, then observe with the Nocturnal upon what Point of the Compass the Guards are; opposite to which in this Table stands the Declination (so called); which if the Star be below the Pole, is to be added to the Altitude; but if the Star be above the Pole, to be subtracted therefrom to find the Latitude of the Place.

But the more exact way to find the Latitude, is by those other Directions for the Stars before given.

Here followeth a Table for the Declination of the North Star, upon every Point of the Compass the Guards are upon, fitted for both sorts of Nocturnals.

	Points of the Compass.	For the guard of the Little Bear.			For the guards of the Great Bear, or aftermost Wheels in Charles's Wain, called the two Pointers.	
		D.	M.		D.	M.
If the former of the Guards be ascending from the North, or lower part of the Meridian.	North.	2	09	The North Star is above the Pole.	2	20
	N. by E.	1	52		2	30
	N. N. E.	1	29		2	35
	N. E. by N.	1	02		2	33
	North East.	0	35		2	26
	N. E. by E.	0	06		2	13
	E. North E.	0	22		1	55
	E. by N.	0	52		1	33
	East.	1	18	The North Star is under the Pole.	1	07
	E. by S.	1	41		0	38
	E. S. E.	2	01		0	08
	S. E. by E.	2	16		0	29
	South East.	2	25		0	28
	S. E. by S.	2	30		1	20
	S. S. E.	2	29		1	44
	S. by E.	2	22		2	04
	South.	2	11		2	20
	S. by W.	1	55	The North Star is under the Pole.	2	30
	S. S. W.	1	34		2	35
	S. W. by S.	1	10		2	33
	South West.	0	43		2	26
	S. W. by W.	0	14		2	13
	W. S. W.	0	15		1	55
	W. by S.	0	44		1	33
	West.	1	11		1	07
If the former of the Guards be descending from the South, or upper part of the Meridian.	W. by N.	1	36	If the two Pointers be descending from the South, or upper part of the Meridian.	0	38
	W. N. W.	1	58		0	08
	N. W. by W.	2	14		0	22
	North West.	2	25		0	52
	N. W. by N.	2	30		1	20
	N. N. W.	2	29		1	44
	N. by W.	2	22		2	04

A. Table of the Latitude and Longitude of the Principal Ports, Harbours, Headlands and Islands in the World; beginning from the Meridian of London. Newly corrected according to the best Observations.

	Places Names.	Latitude.		Longitude.		
		D.	M.	D.	M.	
Coast of Greenland and Nova Zembla.	Acuits Headland	80	20	N 26	40	E
	Fair Foreland	79	26	N 26	33	E
	Point Lookout	76	30	N 14	35	E
	Hope Island	76	29	N 21	16	E
	Cherry Island	74	30	N 20	05	E
	Ice Point	78	00	N 75	44	E
	Cape Nassau	76	30	N 58	50	E
	Admiralties Island	75	06	N 56	50	E
Coast of Lapland and Norway.	Fretum Burrough	71	12	N 67	20	E
	Cape Candense	69	20	N 41	30	E
	Burgen	59	37	N 4	10	E
	Archangel	64	30	N 37	45	E
	Wardshays	70	45	N 30	16	E
	Kildivia Isle	69	15	N 32	00	E
	North Cape	71	24	N 22	10	E
	Naze of Norway	57	50	N 6	45	E
Coast in the Sound	Dronen	65	00	N 11	00	E
	Gottenburgh	57	36	N 12	25	E
	Dantzick	54	23	N 18	52	E
	Stockholm	59	20	N 18	22	E
	Gotland Isle	57	30	N 16	40	E
	Copen-Haven	55	40	N 12	32	E
	Elsenore	56	20	N 12	35	E
	The Scaw	57	23	N 9	46	E
Islands near the Coast of Holland and Flanders.	Hamburgh	53	41	N 10	30	E
	The Texel	53	06	N 5	12	E
	Amsterdam	52	21	N 4	40	E
	Rotterdam	51	55	N 4	17	E
	The Brill	51	50	N 4	15	E
	Kilda Island	57	52	N 9	36	W
	Lewis Island	58	12	N 6	47	W
	Fair Island	59	30	N 3	10	W
Coast of Scotland.	Shotland	60	00	N 3	05	W
	Isles of Orkney	59	10	N 3	16	W
	Barro Island	59	10	N 6	00	W
	Merchants Foreland	64	10	N 16	41	W
	Langeness	66	38	N 17	5	W
	Snow Hill	65	40	N 26	10	W
	London	51	30	N 0	0	

A Table of Latitude and Longitude.

Places Names.	Latitude.		Longitude.		
	D.	M.	D.	M.	
London	51	32	N 00	00	W
Buchanefs	57	50	N 00	36	W
Tinmouth	54	56	N 01	30	W
Flamborough Head	54	07	N 00	10	E
The Spurn	53	34	N 00	12	E
Wintertonness	52	54	N 01	12	E
Orfordness	52	12	N 01	04	E
North Foreland	51	25	N 01	06	E
South Foreland	51	08	N 01	04	E
Dover	51	06	N 01	03	E
Dungeness	50	56	N 00	48	E
Isle of Wight	50	40	N 00	48	W
Portland	50	29	N 02	50	W
The Start	50	08	N 03	46	W
The Lizard	49	56	N 05	23	W
Isles of Silly	49	56	N 06	44	W
Londey's Isle	51	20	N 04	41	W
David's Head	52	00	N 05	20	W
Bristol	51	32	N 02	42	W
Holy Head	53	25	N 04	57	W
Isle of Man	53	40	N 04	55	W
Fair Foreland	55	10	N 06	30	W
Black Rock	54	02	N 10	12	W
Sline Head	53	22	N 09	50	W
Blasques	52	00	N 11	53	W
Cape Clear	51	08	N 10	16	W
Old Head	51	40	N 09	05	W
Dublin	53	11	N 07	37	W
Calis	50	57	N 01	45	W
Seyn Head	49	45	N 00	05	W
Cape Hague	49	47	N 01	33	W
Gurensey	49	33	N 02	28	W
Jersey	49	20	N 02	12	W
Ushant	48	30	N 05	23	W
Brest	48	23	N 04	45	W
Bilboa	43	26	N 02	56	W
Bourdeaux	44	50	N 00	45	W
Cape Ortegal	44	12	N 07	43	W
Cape Finisterre	42	58	N 10	00	W
Lisbon	38	40	N 10	26	W
Cape Vincent	37	15	N 10	35	W
Straights of Gibralter	35	32	N 06	56	W

Coast of England and Scotland.

Coast in the Irish Sea.

Coast of France, Spain, and Portugal.

A Table of Latitude and Longitude.

71

Sea-Coasts in the Straights.

Islands in the Straights.

Places Names.	Latitude.			Longitude.		
	D.	M.		D.	M.	
Cape de Gata	36	56	N	01	13	W
Cape Martin	38	50	N	01	42	E
Marfeilles	43	12	N	05	15	E
Genoa	44	27	N	09	37	E
Rome	41	51	N	12	37	E
Cape Sparteventura	38	00	N	17	43	E
Cape Maria	40	00	N	20	13	E
Naples	41	05	N	15	37	E
Angello	41	48	N	17	50	E
Leghorn	43	20	N	11	28	E
Venice	45	20	N	12	17	E
Cape Mapatan	36	28	N	23	35	E
Scandaroon	36	31	N	38	46	E
Cape Rufato	43	42	N	21	20	E
Tunis	36	42	N	11	50	E
Cape Tres Forcas	35	04	N	02	25	W
Tangier	35	02	N	07	16	W
Alboran	35	54	N	02	40	E
Formentara	38	43	N	03	30	E
Ivica	39	00	N	03	36	E
Majorca	39	40	N	04	12	E
Minorca	40	05	N	05	29	E
Cape Napoli in Sardinia	49	12	N	08	36	E
Cape Corso in Corsica	42	54	N	10	15	E
Limbadosa	35	55	N	14	15	E
Malta	36	00	N	15	50	E
Cape Passaro in Sicilia	37	12	N	16	30	E
Messina	38	20	N	16	40	E
Corfu	39	50	N	21	30	E
Cephalonia	38	10	N	22	33	E
Zant	37	42	N	22	35	E
Cape Spudea in Candia	35	20	N	24	30	E
Candia City	35	02	N	26	12	E
Rhodes	36	40	N	30	12	E
West-end of Cyprus	35	25	N	33	22	E
East-end of Cyprus	35	54	N	36	16	E
Smirna	37	49	N	29	24	E
Constantinople	41	06	N	31	28	E
Salonichi	40	30	N	11	10	E
Alexandria	31	00	N	34	22	E
Lepanto	38	20	N	23	15	E

A Table of Latitude and Longitude.

	Places Names.	Latitude.			Longit.		
		D.	M.		D.	M.	
Coast of Barbary and Guiny.	Cape Spartel	35	24	N	07	09	W
	Cape Cantin	32	42	N	08	54	W
	Cape de Geer	30	10	N	09	06	W
	Cape de Non	28	50	N	10	48	W
	Cape Bojador	27	06	N	15	30	W
	Cape Blanco	19	26	N	17	20	W
	Cape Verde	14	43	N	17	22	W
	River Gamboa	13	50	N	15	26	W
	Cape Roxo	11	54	N	15	38	W
	Cape Mount	05	46	N	10	15	W
	Cape Palmas	04	00	N	07	12	W
	Cape Tres Puntas	03	45	N	01	50	W
	Cape Corse	04	30	N	00	36	W
	Cape Formosa	04	13	N	06	22	E
	Thomas Island	00	00	N	08	20	E
	Cape Negro	16	45	S	14	26	E
	Cape Bona Esperance	34	15	S	17	00	E
Western Islands.	Flores	39	30	N	32	25	W
	Fyal	39	00	N	31	12	W
	Georges	38	58	N	28	26	W
	Tercera	39	33	N	26	51	W
	The East-end of St. Michaels	38	00	N	24	12	W
	St. Mary's	37	00	N	23	47	W
	Gratiosa	39	32	N	27	52	W
Canary Islands.	Ferro	28	05	N	18	25	W
	Palma.	28	54	N	19	00	W
	Gomera	28	10	N	17	32	W
	Teneriff	28	30	N	16	49	W
	Madera	32	25	N	17	42	W
	Canarie	28	00	N	15	56	W
	Forteventura	28	00	N	13	27	W
	Lancerotto	29	06	N	12	47	W
Cape de Verd Islands.	Maio	15	12	N	23	10	W
	Fogo	14	45	N	25	35	W
	Fago	14	56	N	23	42	W
	Sall	17	33	N	21	58	W
	Anabona	02	00	S	06	12	E
	Ascension	08	00	S	14	06	E
	Hellena	15	45	S	06	30	E

A Table of Latitude and Longitude.

73

Places Names.	Latitude.		Longitude.			
	D.	M.	D.	M.		
Cape Anguilloa	34	10	S	18	42	E
Cape Corrientes	24	07	S	36	30	E
Cape Sebastian	23	46	S	37	28	E
Sophala Isles	21	00	S	46	10	E
Quilloa	11	07	S	40	20	E
Cape Falo	10	00	S	40	31	E
Pemba Island	05	52	S	39	27	E
Magadoxa	03	42	N	44	38	E
Socatra Isle	12	10	N	54	00	E
Cape Dorfui	10	20	N	58	40	E
Cape de Gardassin	12	46	N	51	33	E
Cape Aden	14	08	N	44	52	E
Cape Rasfagate	22	51	N	62	10	E
Gulf de Persia	20	58	N	50	00	E
Cape de Jasques	25	30	N	53	00	E
Cape de Guadel	25	00	N	65	10	E
Diul	24	32	N	66	15	E
Cape Jaquack	22	40	N	76	45	E
Surrat	21	13	N	71	46	E
Bomba Isle	21	16	N	71	30	E
Goa	15	30	N	72	07	E
Cape Comorin	08	30	N	77	32	E
River Bengal	22	10	N	115	49	E
Fambes	01	05	N	107	30	E
Siam	14	10	N	100	41	E
Fort St. George	14	31	N	81	12	E
Balasar	21	25	N	86	00	E
Cape Liamto	26	10	N	133	20	E
Nangusaque	32	53	N	127	45	E
Canton in China	23	32	N	144	00	E
Corea	35	00	N	125	00	E
St. Maria at the South-end of Madagascar	25	30	S	48	00	E
St. Maria at the North-end of Madagascar	12	26	S	52	32	E
Diago Roxia	19	12	S	62	00	E
Mauritius	19	40	S	57	00	E
Muscacenus	21	12	S	55	00	E
Timor	10	00	S	124	00	E
The West-end of Java	07	05	S	103	08	E
The East-end of Java	08	00	S	112	30	E
Bantam in Java	05	15	S	105	00	E

Coasts in the East-Indies.

Islands in the East-Indies.

Coasts in the East-Indies.

Islands in the East-Indies.

A Table of Latitude and Longitude.

	Places Names.	Latitude.		Longitude.	
		D.	M.	D.	M.
	Java	07	15	S 110	00 E
	Cambaya	08	16	S 120	33 E
	Sunda Straights	05	45	S 105	00 E
	Achem at the North-west Point of				
	Sumatra	05	35	N 95	12 E
	The South-end of Sumatra	05	13	S 104	16 E
	Coram and Amboyna	03	00	S 127	00 E
	Necassar on the S. end of Celibes	05	30	S 117	30 E
	Manado on the N end of Celibes	02	40	N 122	25 E
	The South-end of Gilolo	01	56	S 126	52 E
	Nassau Isle	03	47	S 99	12 E
	Tidore	00	42	N 124	00 E
	Saladores	03	26	N 149	00 E
	Cape Aert on the East-side of Bornee	01	17	N 116	45 E
	Ouro	01	25	N 87	30 E
	Mindanao	08	00	N 123	00 E
	Betuba	06	45	N 126	50 E
	Matan	11	00	N 121	30 E
	Cheraga	09	35	N 146	45 E
	Jaffanapatan Cape of Ceylon	10	00	N 80	00 E
	Tandaia	12	42	N 122	33 E
	Mindora	13	10	N 117	29 E
	Malabrigo	18	30	N 134	50 E
	Aynam	18	26	N 108	00 E
	Formosa	23	30	N 120	00 E
	Meaco in Japan	35	10	N 135	00 E
	Fado in Japan	36	30	N 141	00 E
	Tandoxima by Japan	31	10	N 141	43 E
	Gora	32	20	N 121	06 E
	Firondo	34	00	N 125	46 E
	Straights of Zungaar	40	30	N 144	20 E
	Cape Blanco	42	30	N 131	00 W
	Port Drake	38	16	N 130	00 W
	Cape Barbara	36	25	N 133	10 W
	Cape St. Lucas	23	35	N 113	12 W
	Cape Corientes	19	16	N 110	30 W
	Cape Corientes	04	48	N 81	20 W
	Cape Blanco	04	30	S 84	10 W
	Ambroso Isles	27	00	S 84	50 W
	Baldivia	10	00	S 81	52 W
	Costro	42	46	S 82	15 W
	C. Victoria at W. entrance of Magellan	51	57	S 84	43 W

Islands in the East-Indies.

Coast of America in the South-Sea.

Cape

A Table of Latitude and Longitude.

75

	Places Names.	Latitude.			Longitude.		
		D.	M.		D.	M.	
C. of America in the South Sea.	Cape Virginia at the East-entrance of						
	Magellan	52	16	S	75	00	W
	Port Julian	48	30	S	78	29	W
	Cape Horn	57	50	S	78	45	W
	Strait Bonaire	54	35	S	73	15	W
	Port Desire	47	50	S	76	59	W
	Cape Antonio	36	50	S	87	25	W
	Cape Maria	34	32	S	55	00	W
	Cape Frio	22	40	S	42	05	W
	Paroibo	05	46	S	36	00	W
The Coast of the Main Continent of America.	Cape Blanco	02	21	S	34	40	W
	North-Cape de Guiana	02	53	N	30	26	W
	Surinam	07	10	N	56	04	W
	Cape de Vella	12	17	N	72	35	W
	Numbre de Dios	09	42	N	83	00	W
	Panama.	09	12	N	83	20	W
	Cape Gratius a Dios	14	37	N	86	04	W
	Cape de Catogh	21	05	N	89	50	W
	Le Vera Cruz	18	40	N	102	12	W
	Cape Florida	25	05	N	81	30	W
	Albly River	33	16	N	78	46	W
	Cape Fair	34	38	N	75	00	W
	Cape Henry	37	00	N	74	00	W
	James Town	37	10	N	75	45	W
	Cape Hattaras	35	13	N	74	50	W
	Cape Charles	37	26	N	73	35	W
	Plymouth in New-England	42	20	N	68	00	W
	Cape Cod	42	24	N	67	52	W
	Cape Ann	43	00	N	72	00	W
	Isle of Sables	43	30	N	65	37	W
Islands in the West Indies.	Cape Britain	45	33	N	59	06	W
	Cape Race	46	30	N	53	30	W
	Cape Bona Vesta	50	12	N	53	24	W
	Bell-Isle	52	10	N	55	00	W
	Charleton Isle in James's Bay	52	12	N	79	38	W
	Bermudus	32	25	N	64	23	W
	Santa Cruz	17	45	N	62	37	W
	St. Christophers	17	18	N	62	34	W
	Antego	17	15	N	61	44	W
	Marigallanta	16	05	N	61	15	W
	Martineco	14	44	N	61	00	W

A Table of Latitude and Longitude.

	Places Names.	Latitude.		Longitude	
		D.	M.	D.	M.
Islands in the West-Indies.	Port-Royal in Jamaica	18	15	N 76	10 W
	Barbadoes	13	10	N 58	32 W
	Tobago	11	10	N 59	00 W
	Trinidad	10	40	N 60	00 W
	Mevis	17	18	N 62	38 W
	Monserat	16	36	N 62	12 W
	Margaretta	11	45	N 63	26 W
	St. Domingo	15	44	N 61	12 W
	Cape Nicolao in Hispaniola	19	57	N 67	39 W
	Cape Roxo in Portorico	18	20	N 70	00 W
	Cape Antonio on Cuba	22	10	N 85	00 W
	Cape Cruz on Cuba	19	00	N 75	00 W
	Cape May on Cuba	20	10	N 73	15 W
	The Havana on Cuba	22	30	N 83	30 W
	Isle of Ash	18	20	N 66	50 W

The Use of the Table of Latitude and Longitude.

In the Table there are six Columns, the first shews the Sea-Coasts about the World in general; the second the particular places; the third shews the Latitude; the fourth shews whether the Latitude be North or South, in which N stands for North, and S for South Latitude; the fifth shews the Longitude, being accounted Easterly or Westerly from the Meridian of London, as is denoted in the sixth and last Column, by the Letters E. and W.

To find the Latitude and Longitude of Places.

Suppose the Latitude and Longitude of *Silly* be desired.

Look in the Table for the Coast of *England* in the first Column, and in the 2^d for *Silly*; over against which, in the third Column, stands $49^{\circ} 56'$, and in the fourth N, which shews the Latitude of *Silly* to be $49^{\circ} 56'$ North; in the fifth Column stands $6^{\circ} 44'$, and W in the sixth shews the Longitude of *Silly* to be $6^{\circ} 44'$ West, from the Meridian of London.

To find the Difference of Longitude between two places.

First, if the Longitudes have the same name, that is, if they are both East, or both West; then subtract the lesser Longitude out of the greater, and the Remainder is the difference of Longitude.

Examp. What is the difference of Longitude between *Bermudes* and *Cape-Cod* in *New-England*?

The Longitude of *Cape-Cod* is $67^{\circ} 52' W.$

The Longitude of *Bermudes* $64^{\circ} 23' W.$

The Difference of Longitude required $3^{\circ} 29'$

Second:

Secondly, if the Longitudes have different names, that is, if the one is West, and the other East; Then add the Longitudes together, and the Sum if it be less than 180 deg. is the Difference of Longitude; But if it exceed 180 deg. it's Complement to 360 deg. is the Difference of Longitude.

Examp. 1. What is the difference of Longitude between Cape-Cod in New-England, and Gottenberg in Norway.

The Longitude of Cape-Cod	67 52 W.
The Longitude of Gottenberg	12 25 E.
The Difference of Longitude	80 17

Example 2. What is the Difference of Longitude between Canton in China and Cape Horn.

The Longitude of Canton	114 00 E.
The Longitude of Cape Horn	78 45 W.
Sum greater than 180 deg.	192 45
Therefore subtract it from	360 00
The Difference of Longitude required	167 15

Problems of Plain Sailing, wrought by the Logarithms, and by Gunter's Scale.

PROBLEM I.

THE Course and Distance being given; to find the Difference of Latitude and Departure.

Example. Suppose a Ship sail South-west by South, 382 minutes, and it be required to find the Difference of Latitude and Departure.

In the Triangle ABC

AC represents the Distance sailed

AB the Difference of Latitude

BC the Departure

BAC (or the Angle at A) the Angle of the Course

ACB (or the Angle at C) the Complement of the Course to 90°.



Characters used in Navigation and Astronomy.

S. stands for Sine.

T. for Tangent.

Sc. Sine Complement. Tc. Tangent Complement.

The given Sides and Angles of a Triangle are marked with a dash thus (—).

The required Sides and Angles with Pricks thus (∴).

The

Plain Sailing.

The Operation by the Logarithms, for the Difference of Latitude

As Radius	10.0000000
To the Distance sailed 382	2.5820634
So is Sc. of the Course $33^{\circ} 45'$	9.9198464
To the Difference of Latitude, 317 required	2.5019098

For the Departure.

As Radius	10.0000000
To the Distance, sailed 382	2.5820634
So is S. of the Course $33^{\circ} 45'$	9.7447390
To the Departure, which is 212	2.3268024

The Operation by Gunter's Scale.

For the Difference of Latitude.

One foot of the Compasses being in the Radius (or Sine of 90° deg.) extend the other to the Sine of $36^{\circ} 15'$ the Complement of the Course, and the same extent shall reach the same way (*viz.* decreasing) from the Distance 382, to the Difference of Latitude 317, which was required.

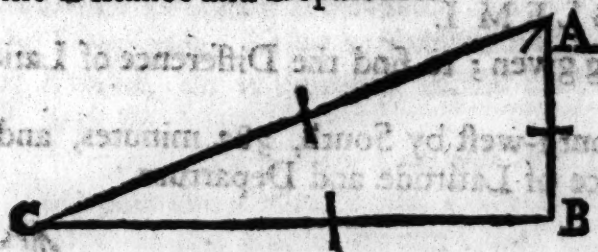
For the Departure.

The extent of the Compasses from the Radius (or Sine of 90°) to the Sine of the Course $33^{\circ} 45'$, the same extent shall reach (the same way) from the Distance 382, to the Departure, which is 212.

P R O B. II. The Course and Difference of Latitude given, to find the Distance and Departure.

Example.

Suppose a Ship sail W.S.W. until the Difference of Latitude be 219, and the Distance and Departure required.



The Operation by the Logarithms. For the Distance.

As Sc. of the Course $67^{\circ} 30'$	9.5828397
To the Difference of Latitude 219	2.3404441
So is Radius	10.0000000
To the Distance, which is 572	2.7576044

For the Departure.

As Radius	10.0000000
To the Distance 572	2.7573960
So is S. of the Course $67^{\circ} 30'$	9.9656153
To the Departure, which is 528	2.7230113

By the Gunter.

For the Distance. The Compasses being extended from the S. of $22^{\circ} 30'$, the

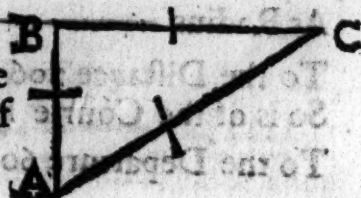
the Complement of the Course to the Radius, the same extent shall reach the same way (*viz.* increasing) from the Difference of Latitude 219, to the Distance, which is 572.

For the Departure. The extent of the Compasses from Radius, to the S. of the Course $67^{\circ} 30'$, shall reach (the same way) from the Distance 572 to the Departure, which is 528.

P R O B. III. The Course and Departure given, to find the Distance and Difference of Latitude.

Example.

Suppose a Ship sail North-east by East, until the Departure be 220, the Distance and Difference of Latitude required.



By the Logarithms.
For the Distance.

As S. of the Course $56^{\circ} 15'$	9.9198464
To the Departure 220	2.3424227
So is Radius	10.0000000
To the Distance, which is 264	2.4225763

For the Difference of Latitude.

As Radius	10.0000000
To the Distance 264	2.4216039
So is Sc. of the Course $56^{\circ} 15'$	9.7447390
To the Difference of Latitude, which is 146	2.1663429

By the Gunter.

For the Distance.

The extent of the Compasses from the S. of the Course $56^{\circ} 15'$, to the Radius, shall reach (the same way) from the Departure 220, to the Distance, which is 264.

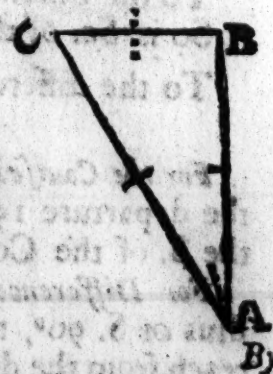
For the Difference of Latitude.

The extent of the Compasses from Radius to the S. of $33^{\circ} 45'$, the Complement of the Course, shall reach from the Distance 264, to the Difference of Latitude, 146 required.

P R O B. IV. The Distance and Difference of Latitude given, to find the Course and Departure.

Example.

Suppose a Ship sail between the North and the West, 206 min. until the Difference of Latitude be 197, the Course and Departure required.



Plain Sailing.

By the Logarithms.
For the Course.

As the Distance 206 ————— 2.3138672

To Radius ————— 10.0000000

So is the Difference of Latitude 197 ————— 2.2944662

To the Sc. of the Course; which is N. 17° 00' W. ————— 9.9805990

For the Departure.

As Radius ————— 10.0000000

To the Distance 206 ————— 2.3138672

So is of the Course 17° 00' ————— 9.4659353

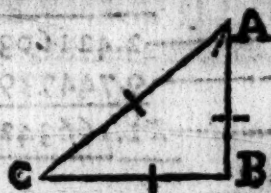
To the Departure 60 ————— 1.7798025

By the Gunter.

For the Course. The extent from the Distance 206, to the Diff. of Latitude 197, shall reach from Radius, to the S. of 73° 00', the Complement of the Course, which subtracted from 90, is the Course required.

For the Departure. The extent from Radius or S. 90°, to the S. of the Course 17° 00', shall reach from the Distance 206, to the Departure 60 required.

PROB. V. The distance and departure given, to find the Course and Difference of Latitude.



Example.

Suppose a Ship sail between the South and the West 247 Minutes, until the Departure be 197, and it be required to find the Course and Difference, of Latitude.

The Operation by the Logarithms.
For the Course.

As the distance 247 ————— 2.3926969

To Radius ————— 10.0000000

So is the departure 197 ————— 2.2944662

To the S. of the Course, which is 52° 54' ————— 9.9017693

For the Difference of Latitude.

As Radius ————— 10.0000000

To the distance 247 ————— 2.3926969

So is Sc. of the Course 52° 54' ————— 9.7804671

To the difference of Latitude, which is 149 ————— 2.1731640

By the Gunter.

For the Course. The extent of the Compasses from the distance 247, to the departure 197, shall reach the same way from Radius or S. 90°, to the S. of the Course, which 52° 54'.

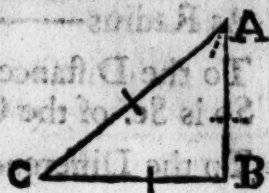
For Difference of Latitude. The extent of the Compasses from Radius or S. 90°, to the S. of 37° 6', the Complement of the Course, will reach from the distance 247 to the difference of Latitude, which is 149.

PROB.

PROB. VI. The difference of Latitude and Departure given, to find the Course and Distance.

Example.

Suppose a Ship sail between the South and the East, until her Difference of Latitude be 210 min. her Departure 200, and it be required to find the Course and Distance.



The Operation by the Logarithms. For the Course.

As the Difference of Latitude 210 ————— 2.3222193

To Radius ————— 10.0000000

So is the Departure 200 ————— 2.3010300

To the T. of the Course $43^{\circ} 36'$ required ————— 9.9788107

For the Distance.

As the Sc. of the Course $43^{\circ} 36'$ ————— 9.8598416

To the Difference of Latitude 210 ————— 2.3222193

So is Radius ————— 10.0000000

To the Distance which is 290 ————— 2.4623777

By the Gunter.

For the Course. The extent of the Compasses from the Difference of Latitude 210, to the Departure 200, shall reach from Radius in the Tangents, (which is the Tangent of 45°), to the Tangent of the Course, which is $43^{\circ} 36'$.

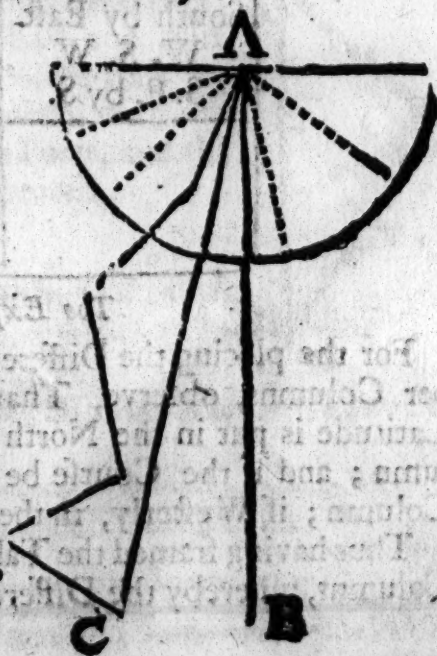
For the Distance. The extent from the S. of $46^{\circ} 24'$, the Complement of the Course, to the Radius or the Sine of 90° , will reach from the Difference of Latitude 210, to the Distance, which is 290.

PROB. VII.

This Problem shews the manner of working a Traverse, and is very useful in keeping a Reckoning by Plain Sailing.

Example.

Suppose a Ship bound to a certain Port, and she sails thither S. S. W. 40 minutes, then S. W. 60 min. then South by East 63 min. W. S. W. 49 min. then S. E. by South 56 min. and the Difference of Latitude and Departure the Ship hath made, with the direct Course and Distance is required.



L

The

Plain Sailing.

The Operation by the Logarithms.

For the Difference of Latitude of the First Course.

As Radius	10.0000000
To the Distance 40	1.6020600
So is Sc. of the Course $22^{\circ} 30'$	9.9656153
To the Difference of Latitude, 36	11.5676753

For the Departure of the first Course.

As Radius	10.0000000
To the Distance, 40	1.6020600
So is S. of the Course $22^{\circ} 30'$	9.15828397
To the Departure 15 required	11.1848997

By the Gunter.

For the Difference of Latitude.

The extent of the Compasses from Radius or S. 90° , to the S. of $67^{\circ} 30'$, the Comp. of the Course, will reach from the Distance 40, to the Difference of Latitude 36 required.

For the Departure.

The extent from Radius or S. 90° , to the S. of the Course $22^{\circ} 30'$, shall reach from the Distance 40, to the Departure 15 required.

In the same manner proceed to find the Difference of Latitude and Departure for each Course and Distance; which being found, place in a Table as follows.

The Traverse Table.

Courses.	Dist.	North.	South.	East.	West.
S. S. W.	40		36		15
South-West	60		42		42
South by East	63		61	12	
W. S. W.	49		131		45
S. E. by S.	56		46	31	
			203	43	102
					43
					59

The Explanation of the Table.

For the placing the Difference of Latitude and Departure in their proper Columns, observe, That if the Course be North, the Difference of Latitude is put in the North Column; if it be South, in the South Column; and if the Course be Easterly, the Departure is put in the East Column; if Westerly, in the West Column.

Thus having framed the Table, add up the North, South, East, and West Columns, whereby the Difference of Latitude appears to be 203 Minutes

South

Oblique Plain Sailing.

83

South, because there's nothing in the North Column; the Départure 59 minutes West, because so much the West Column exceeds the East: By which difference of Latitude and Departure, find the direct Course and Distance as follows

The Operation by the Logarithms. For the direct Course.

As the Difference of Latitude 203	2.3074960
To Radius	10.0000000
So is the Départure 59	1.7708520
To the T. of the Course 16° 12' South-West,	9.4633560
because the South and West Columns ex- ceed the North and East	

For the direct Distance.

As Sc. of the Course 16° 12'	9.9824041
To the difference of Latitude, 203	2.3074960
So is Radius	10.0000000
To the Distance required, which is 211	2.3250919

By the Gunter. For the direct Course.

The extent of the Compasses from the Difference of Latitude 203, to the Départure 59, shall reach from Tang. 45° (or Radius) to the Tang. of 16° 12', the Course required.

For the direct Distance.

The extent from the S. of 73° 48', the Comp. of the Course, to S. of 90° (viz. Radius) shall reach from the Difference of Latitude 203, to the Distance 211 required.

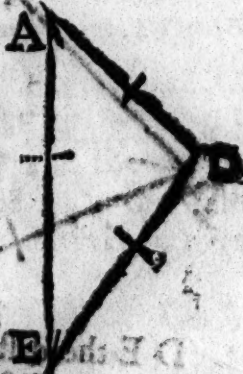
Oblique angled Plain Triangles, applied in PROBLEMS of Plain Sailing, and wrought by the Logarithms and Gunter's Scale

PROB. I. The Angles and one of the Sides given to find either of the other Sides. *Example.*

Suppose there are two Ports both under one Meridian: A Ship sails from the Northernmost South-East 206 min. another Ship sails from the Southernmost North-East by North, a certain number of minutes, and meets with the first Ship: The Distance between these two Ports, and the Distance sailed by the second Ship, are required.

In the Triangle A D E.

A and E represent the two Ports. AD the first Ship's Distance. ED the second Ship's Distance. AE the Distance between the two Ports.



The Operation by the Logarithms. For the Distance between the two Ports.

As S. AED 33° 45'	Co.Ar. 0.2552610
To AD the first Ship's Distance 206	2.3138672
So is S. ADE 101° 15'	9.9915739
To AE the Distance between the two Ports 362	2.5607021

Oblique Plain Sailing:

In this Operation, to save the labour of subtracting the first Log. from the Sum of the 2d and 3d, use the Complement Arithmetical of the first Logarithm, which is found by subtracting each Figure of the Logarithm from 9, except the first towards the right hand, which is subtracted from 10, as in the Operation, the Logarithm Sine found in the Table, is 9.7447390 wherefore beginning at the left hand, say; 9, from 9, there remains 0; 7 from 9, remains 2; 4 from 9, remains 5; 4 from 9, remains 5; 7 from 9, remains 2; 3 from 9, there remains 6; 9 from 10, remains 1, and there insert the 0: So the Complement Arithmetical of the first Logarithm, is 0.2552910, as it stands in the Operation.

For the Second Ship's Distance.

Co.Ar.

As S.AED $33^{\circ} 45'$	0.2552610
To A D the first Ship's Distance 206	2.3138672
So is S. DAE $45^{\circ} 00'$	9.1494850
To DE the second Ship's Distance 262 required	2.4186132

By the Gunter. For the Distance between the two Ports.

The extent of the Compasses from the S. of $33^{\circ} 45'$, to S. A D E $78^{\circ} 45'$, (viz. the Complement of $101^{\circ} 15'$ to 180°) shall reach from 206 the first Ship's distance, to 363 the distance between the two Ports required.

For the Second Ship's Distance.

The extent of the Compasses from the S. of $33^{\circ} 45'$, to the S. of $45^{\circ} 00'$, shall reach from 206, the first ship's distance, to 262 the second Ship's distance required.

P R O B. II.

Two sides and an Angle opposite to one of them being given, to find the other opposite Angle, and the third side.

Example. Suppose two Ports, whose bearing is North-East and South-west, distant 396 min. a Ship at the Northermost sails S.S.E. and another Ship at the Southermost sails thence 518 min. and meets with the first Ship: The Course sailed by the second Ship, and the first Ship's distance are required.

In the Triangle ADE.

A and D represent the two Ports.

A D the distance between them.

D E the distance sailed by the first Ship.

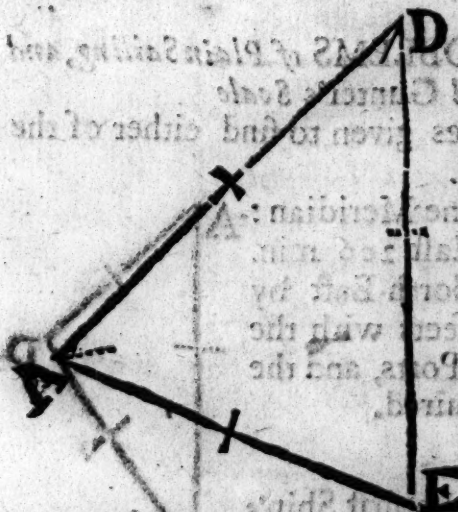
A E the distance sailed by the second Ship.

The Operation by the Logarithms. For the second Ship's Course.

Co.Ar.

As A E the second Ship's distance 518	7.2856702
To S. ADE $67^{\circ} 30'$	9.9656153
So is A D the distance between the two Ports 396	2.5976652
To S. AED $44^{\circ} 56'$	6.8482807

The



Oblique Plain Sailing.

85

The Angle at D $67^{\circ} 30'$ and the Angle at E $44^{\circ} 56'$, being added together, and subtracted from 180° , gives $67^{\circ} 34'$, the Angle at A which makes nearest 6 Points: and 6 Points reckoned from the North-east to the Southward, gives E.S.E. the second Ship's Course required.

For the first Ship's Distance,

	Co.Ar.
As S. D E $67^{\circ} 30'$ _____	0.0343847
To A E the second Ship's distance 518 _____	2.7143268
So is S. DAE $67^{\circ} 34'$ _____	9.9658243
To DE the first Ship's distance 518 required _____	2.7145388

By the Gunter.

The extent of the Compasses from the distance 518, to the distance between the two Ports 396, shall reach from S. of $67^{\circ} 30'$. to S. $44^{\circ} 56'$, which added to the Angle at D, and the Sum subtracted from 180 , gives $67^{\circ} 3'$, the Angle at A.

For the first Ship's Distance. The extent from S. $67^{\circ} 30'$. to $67^{\circ} 34'$, shall reach from the 2d Ship's distance 518, to the 1st Ship's dist. 518 required.

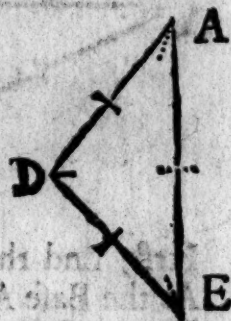
PROB. III.

Two sides and the contained Angle given, to find the other Angle.

Example.

Suppose two Ships sail from one Port; one sails North-east 140 minutes, the other South-east by East 115 minutes, the bearing and dist. of these two ship's is required.

Let D represent the Port, DA the first Ship's distance, and DE the second,



The Operation by the Logarithms. For the Bearing of the two Ships.

	Co.Ar.
As the Sum of the sides AD and DE 255 _____	7.5934598
To the difference of the said sides 25 _____	1.3979400
So is the T. of half the Sum of their opposite Angles $50^{\circ} 37'$ _____	10.0856980
To the T. of half their Difference, which is $6^{\circ} 48'$ _____	19.0770978

The half Difference added to the half Sum, gives $57^{\circ} 25'$, the greater Angle. The half difference subtracted from it, gives $43^{\circ} 49'$, the lesser Angle: Wherefore the bearing of the two Ship's is North-easterly, or south westerly $1^{\circ} 11'$.

For the Distance of the Ships.

	Co.Ar.
As AED $57^{\circ} 25'$ _____	0.0743739
To AD the first Ship's distance 140 _____	2.1461280
So is S. ADE $78^{\circ} 45'$ _____	9.9915739
To AE the distance of the Ships 163 fere _____	2.2120758

By the Gunter. For the bearing of the Ships.

The extent of the Compasses from the Sum of the Sides 255, to their Difference 25, shall reach from the T. of the half Sum of the required Angles $50^{\circ} 37'$ to the T. of half the Difference of the said Angles $6^{\circ} 48'$.

In

In the foregoing Operation by the *Gunter*, the Practitioner may be at a loss because in extending the Compasses from the T. of $50^{\circ} 37'$ decreasing, they will fall beyond the T. of 45° at the end of the Line. To remedy this, place the extent (from 255 to 25) from the T. 45° and it will reach to T. of 5.37 ; then letting one Point stand at 5.37 , extend the other to the T. 50.37 . This extent place from the T. 45 , shall fall on the T. 6.48 . requir.

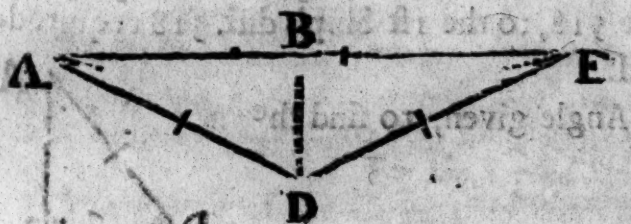
For the Distance of the Ships.

The extent of the S. of 57 deg. 25 min. to the S. 78 deg. 45 min. shall reach from 140 to 163 required.

P R O B. IV. Three Sides being given, to find an Angle.

Example Suppose there are two Ports both in one Latitude, distant 536 min. a ship sails from the Easternmost 306 min. between the South and the West: Another Ship sails from the westernmost 290 min. and meets with the first Ship. The Course that each Ship steer'd is required.

Let A and E represent the two Ports, D the place where the Ships meet.



This Question is resolved, by letting fall the perpendicular DB; so reducing the Oblique Triangle ADE, into the two right-angled Triangles ABD and BDE, then the Operation is as follows.

The Operation by the Logarithms.

First, find the Segment of the Base BE, thus;

As the Base AE 536 C. Ar. 7.2708352

To the Sum of the sides AD and ED 596 2.7752463

So is the difference of the said sides 16 1.2041200

To a Segment of the Base, which is 17 1.2502015

The whole Base is 536

The Segment is 17

Sum 553

Half-Sum 276 is the greater Segment BE.

Then say, *For the first Ship's Course.*

As DE the first Ship's distance 306 2.4857214

To Radius 10.0000000

So is the greater Segment BE 276 2.4409091

To Sc. BED $25^{\circ} 35'$ 9.9551877

The Angle at E is the Course from the West Southerly, so the first Ship steers South $64^{\circ} 25'$ West, or S. W. by W. three quarters W. *scilicet*.

For the second Ship's Course.

As AD the second Ships distance 290 Co. Ar. 7.5376020

To S. AED $25^{\circ} 35'$ 9.6353062

So is DE the first Ships distance 306 2.4857214

To S. DAE $27^{\circ} 06'$ 9.6586296

The

The Angle at A is the Course from the East Southerly, so the second Ship steers South $62^{\circ} 54'$ East, or S. E. by E. $\frac{1}{2}$ E.

By the Gunter. For the Segment of the Base.

The Extent of the Compasses from the Base AE 536, to the Sum of the sides 569, shall reach from the difference of the sides 16, to the Segment of the Base 17, with which proceed as before.

For the first Ship's Course.

The Extent from the distance 306, to the greater Segment 276, shall reach from Radius or S. 90° , to S. $64^{\circ} 25'$ the Comp. of BED $25^{\circ} 35'$ required.

For the second Ship's Course.

The Extent from 290 the second Ship's distance, to 306 the first Ship's distance, shall reach from the S. $25^{\circ} 35'$ to the S. $27^{\circ} 06'$, the Angle at A required.

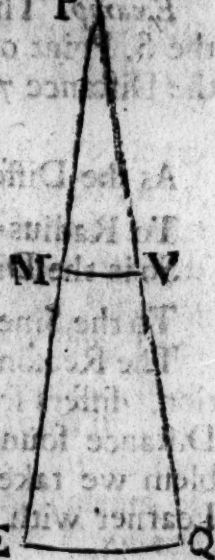
PROB. I. Of Mercator's Sailing.

TWO places in the same parallel of Latitude, the difference of Longitude between them given, to find the Distance of those places in the Parallel.

Example.

Cape St. Vincent, and the S. Point of St. Mary's, both in the Lat. $37^{\circ} 0'$ N. the Difference of Longitude between them $16^{\circ} 40'$ (or 1000 min.) to find the distance.

In the annexed Scheme, P represents the North Pole, EQ an Arch of the Equinoctial, M St. Mary's, V Cape St. Vincent, PME the Meridian of St. Mary's, PVQ the Meridian of Cape St. Vincent, the Angle MPV, or the Arch EQ, the Difference of Longitude between St. Mary's and Cape St. Vincent, MV the distance between them in the parallel of Latitude.



The Operation by the Logarithms.

As Radius ————— 10.0000000

To the difference of Longitude 1000 min: ————— 3.0000000

So is the Sine Comp. of the Lat. $37^{\circ} 00'$ ————— 9.9023486

To the Distance between them 798 $\frac{6}{10}$ min: ————— 2.9023486

The Operation by Gunter's Scale.

The extent from the S. 90° , to the S. 53° , the Comp. of Latitude, shall reach from the Diff. of Longitude 1000 min to the Distance 798.

PROB.

P R O B. II.

Two places both in the same Latitude, the distance (in the Parallel) between them given, to find the Difference of Longitude.

Examp. Cape St. Vincent, and the S. Point of St. Mary's, both in the Latitude of $37^{\circ} 0'$ N. the Distance between them 799 min. to find the Difference of Longitude.

The Operation by the Logarithms.

As the Sine Comp. of the Lat. $37^{\circ} 0'$	9.9023486
To the distance 799 min.	2.9025468
So is Radius	10.0000000
To the difference of Longitude 1000 min.	3.0001982

The Operation by Gunter's Scale.

The Extent from the S. $53^{\circ} 0'$ (the Comp. of the Lat.) to the S. 90° ; shall reach from the distance 799, to the diff. of Longitude 1000.

P R O B. III.

The Difference of Longitude and Distance between two places, both in the same Latitude; to find the Latitude.

Examp. The Difference of Longitude between Cape St. Vincent, and the S. Point of St. Mary's, being in the same Latitude, is $16^{\circ} 40'$, and the Distance 799 min. to find the Latitude of those Places.

The Operation by the Logarithms.

As the Difference of Longitude 1000 min.	3.0000000
To Radius	10.0000000
So is the Distance 799 min.	2.9025468
To the Sine Comp. of the Lat. $36^{\circ} 58'$	9.9025468

The Reason why the Latitude of the two places found by this Operation, differs from the Latitude given in the first Problem, is, because the Distance found by that Problem is 798 min. $\frac{1}{10}$, but in the third Problem we take the Distance 792 min. being unwilling to trouble the Learner with Fractions.

The Operation by the Gunter's Scale.

The Extent from the Diff. of Longitude 1000, to the Distance 799; shall reach from the S. 90° , to the S. $53^{\circ} 02'$, whose Comp. (to 90°) is $36^{\circ} 58'$, the Latitude required.

P R O B. IV.

To find the Meridional Difference of Latitude between any two places, by the Table of the Logarithmical Tangents.

How it was first discover'd is uncertain, but it was first published by Mr. Henry Bond, in the 2d Edition, of Gunter's Works, 1636; and afterwards by the same Author, in the 1st Edition of Norwood's Epitomy, 1645, that

that the *Logarithmical Tang. Complements* of half the *Comp.* of the *Latitude* are proportional to the *Sum* of the *Seconds*, or the *Meridian Line* in *Mercator's Chart* (commonly so called) altho 'tis certain 'twas *Mr. Wright's* Invention, (and ought to bear his Name) as he has made it appear in the *Preface* of his *Book*; the *Correction of Errors in Navigation*, first published 1599. This Analogy was afterwards demonstrated by the Learned *Mr. James Gregory* in his *Exercitationes Geometricæ* 1668, and very lately by my Friend *Mr. Edmond Halley*, who according to his happy Genius, hath very clearly and succinctly demonstrated in the *Philosophical Transactions*, N^o 219, published 1696, that the *Logarithmick Tangents*, are Analogous to the *Meridian Line*, and that as the *Meridian Line* is a *Table* of the *Difference of Longitude*, to every *Minute of Latitude*, on the 1st Rhumb from the *Meridian*; so the *Logarithmick Tangents*, are a *Table* of the *Difference of Longitude*, to every *Minute of Latitude* on some determinate Rhumb. And as the *Tangent* of that Rhumb, to the *Tangent* of any other Rhumb; so is the *Difference* of the *Logarithms* of any two *Tangents*, to the *Difference of Longitude* on the proposed Rhumb, intercepted between the two *Latitudes* of the whole half *Complement*, you took the *Tangent* or *Tangent Complement*. The *Meridional Difference of Latitude* for 1 min. of *Latitude* from the *Equinoctial* in the *Scale of Logarithmick Tangents* (by the common *Tables*) is 1263, and in *Vlacq's Canon Magnus*, 1263311.

Therefore as 1263, to 1 min. so is the difference of any two *Logarithmick Tangents*, to the *Meridian Difference of Latitude* in *Minutes*, between those two *Arches* in the *Quadrant*, of whose half *Complements* the *Tangents* or *Tangent Complements* were taken. And as 1 min. to *Radius*, so is 1.263, to the *Tangent* of $51^{\circ} 38'$; the *Angle* that Rhumb makes with the *Meridian*, on which the *Scale of Brigg's Logarithm-Tangents*, are a *Table* of the *Diff. of Long.* Or as 1 min. to *Radius*; so is 1.263311, to the *Tangent* $51^{\circ} 38' 9''$, as *Mr. Halley* determined it.

1. If the two places be both in *North* and *South Latitude*, divide the *Difference* of the *Logarithmical Tangents*, or *Tangent-Complements*, of half the *Compl.* of the *Latitude* to 90 degrees, by 1263, the *Quotient* in the *Meridional Difference of Latitude* in *Minutes*.

Examp. Suppose two places, one in *Lat.* $50^{\circ} 10'$, the other in *Lat.* $37^{\circ} 54'$, (both *North* or *South Latitude*) to find the *Meridional Difference of Latitude* between them. *Lat.* $50^{\circ} 10'$, *Comp.* $39^{\circ} 50'$, half *Comp.* $19^{\circ} 55'$.

Lat. $37^{\circ} 54'$ *Comp.* $52^{\circ} 06'$, $\frac{1}{2}$ *Comp.* $26^{\circ} 03'$.

The *Log. T.* of $19^{\circ} 55'$ — 9.5590971 *T. C.* of $19^{\circ} 55'$ — 10.4409029

The *Log. T.* of $26^{\circ} 03'$ — 9.6891430 *T. C.* of $26^{\circ} 03'$ — 10.3108570

The *Diff.* ————— 1300459 The *Diff.* ————— 1300459

1263) 1300459 (1029 the *Merid. Diff.* of *Latitude* in *Minutes*.

2. If one place be under the *Equinoctial*, and the other in *North* or *South Latitude*.

Divide the Difference of the Log. Tangents, or Tang. Complements, of half the Complement of the Latitude and of the Tangents of 45 deg. by 1263, the Quotient is the Meridional Difference of Latitude in Minutes.

Example One place under the Equinoctial, and the other in the Lat. $30^{\circ} 10'$, to find the Meridional Difference of Latitude.

The Log. T. of $19^{\circ} 55'$ — 9.5590971 T. C. of $19^{\circ} 55'$ — 10.4409020

The Log. T. of $45^{\circ} 00'$ — 10.0000000 T. of $45^{\circ} 00'$ — 10.0000000

The Diff. 4409029 The Diff. 4409029

1263) 44°02'29" (349° the Merid. of Diff. the Latitude in Minutes

3. If one place be in North, and the other in South Latitude. Divide the Sum of the two Differences, of the Tang. of 45 deg. and the Tangents or Tang. Complements of half the Comp. of the two Latitudes, by 1263; the Quotient is the Meridional Difference of Latitude.

Examp. Suppose one place in the Lat. $50^{\circ} 0'$ N. the other in the Lat. $32^{\circ} 20'$ S. to find the Meridional Difference of Latitude in Minutes.

The difference of the Tang. of 45° , and the Tang. or Tang. Comp. of $20^\circ 0'$, is 4389341, the Difference of the Tang. of 45° , and the Tang. or Tang. Comp. of $28^\circ 50'$, is 2592328, the Sum of these two Differences, 6981669; divide by 1263, the Quorient 5527 is the Meridional Difference of Latitude in minutes.

The Operation of this Problem by the *Gunter's Scale* is omitted, it not being sufficient to exhibit the Answer in Minutes.

PROB. V.

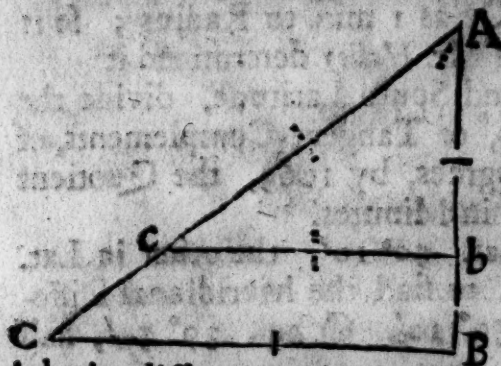
Both Latitudes, and the differences of Longitude given, to find the Course, the Distance and the Departure.

Example The *Lizard* in the Lat. $50^{\circ} 10' N.$ and the East-end of *St. Michael's*, in the Latitude of $37^{\circ} 54' N.$ the difference of Longitude between them 22 deg. or 2320 min. to find the Course from the *Lizard* to *St. Michael's*, the Distance and Departure between them.

In the two Triangles $A b c$ and $A B C$.

C  **B** A c represents the distance sailed, A b the difference of Latitude, b c the departure from the Meridian (as in Plain Sailing) AB the Meridional difference of Latitude, BC the difference of Longitude, according to *Mercator's Sailing*, BAC the Course, A c b or ACB the Complement of the Course.

The diff. of Lat. in Meridional Parts, found by the 4th Problem, is 1029 Minutes:



The Operation by the Logarithms to find the Course.

As the Meridional Difference of Latitude 1029 min. ————— 3.0124154
 To Radius ————— 10.0000000
 So is the Difference of Longitude 1320 min. ————— 3.1205739
 To Tang. of the Course $52^{\circ} 03'$ ————— 10.1081585
 The Course is S. $52^{\circ} 03'$ W. or S. W. almost $\frac{1}{2}$ W.

To find the Distance sailed.

As Radius ————— 10.0000000
 To the difference of Latitude 736 min. ————— 2.8668778
 So is Secant of the Course $52^{\circ} 03'$ ————— 10.2121435
 To the distance sailed 1197 min. ————— 23.0780213

To find the Departure from the Meridian.

As Radius ————— 10.0000000
 To the difference of Latitude 736 min. ————— 2.8668778
 So is the Tang. of the Course $52^{\circ} 03'$ ————— 10.1079715
 To the departure from the Meridian 943 min. ————— 22.9748493

The Operation by Gunter's Scale. To find the Course.

Extend the Compasses from the Meridional difference of Latitude 1029, to the difference of Longitude 1320; the same extent shall reach from the Tang. 45° , to the Tang. of the Course $52^{\circ} 03'$.

To find the Distance sailed.

Extend the Compasses from the Sine of 90° , to the Sine of $37^{\circ} 57'$; the same extent shall reach from the difference of Latitude 736, to the distance 1197.

Note, The Secants are accounted upon the Line of Sines, from the Sine of 90° backward, towards the beginning of the Line: the Sine of 80° , representing the Sec. of 10° , the Sine of 70° the Sec. of 20° , the Sine of 30° the Sec. of 30° , &c.

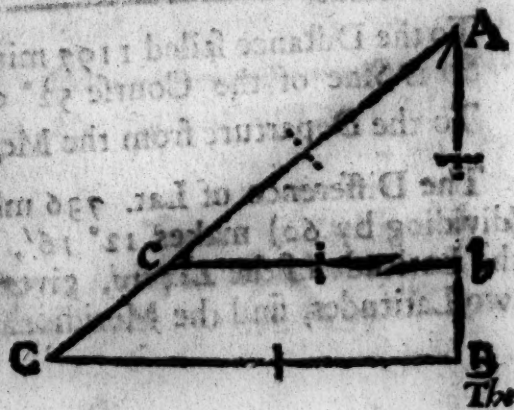
To find the Departure from the Meridian.

The extent of the Compasses, from the Tang. of 45° , to the Tang. of the Course $52^{\circ} 03'$; shall reach from the difference of Latitude 736, to the departure 943.

PROB. VI.

One Latitude, the Course and difference of Longitude given, to find the other Latitude, the Distance and the Departure.

Examp. The Lizard in the Lat. $50^{\circ} 10'$ N. the Course from thence S. $52^{\circ} 03'$ W. and the difference of Longitude 22° , to find the Latitude of the other place, the distance and the departure between them.



Mercator's Sailing

The Operation by the Logarithms, To find the other Latitude

As the Tang. of the Course $52^{\circ} 03'$ 10.1079715

To the difference of Longitude 1320 min. 3.1205739

So is Radius 10.0000000

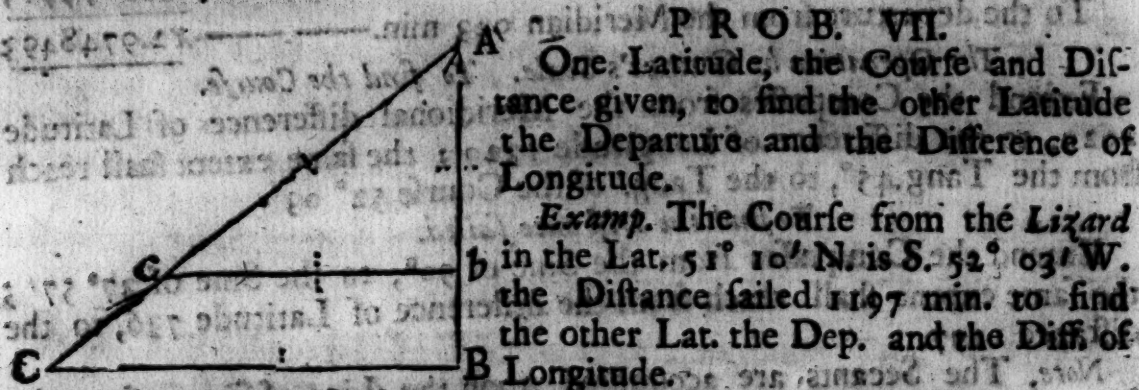
To the Meridian Difference of Lat. 1029 min. 3.0126024

Multiply 1029 by 1263, the Product 1299627, subtract from 10.4409029 the Tang. Comp. $19^{\circ} 55'$ (the half Comp. of $50^{\circ} 10'$), the remainder 10.3109402 is the Tang. Comp. of $26^{\circ} 03'$, the double whereof $52^{\circ} 06'$ subtracted from 90 deg. leaves the Latitude of the second place $37^{\circ} 54' N$.

Having both Latitudes and the Course, find the distance and departure, as in the 5th Problem.

The Operation by Gunter's Scale, To find the Meridional Diff. of Lat.

Extend the Compasses from the Tang. of the Course $52^{\circ} 03'$, to the Tang. of 45° ; the same extent shall reach from the Diff. of Longitude 1320, to the Meridional Diff. of Latitude 1029; by which find the other Latitude, as above.



The Operation by the Logarithms, To find the other Latitude.

As Radius 10.0000000

To the Distance sailed 1197 min. 3.0780941

So is the Sine Comp. of the Course $52^{\circ} 03'$ 9.7888565

To the difference of Latitude 736 min. 12.8669506

To find the Departure.

As Radius 10.0000000

To the Distance sailed 1197 min. 3.0780941

So is Sine of the Course $52^{\circ} 03'$ 9.8968280

To the Departure from the Meridian 943 min. 22.9749121

The Difference of Lat. 736 min. reduced into Degrees and Minutes, (dividing by 60) makes $12^{\circ} 16'$, which subtracted from the $50^{\circ} 10' N$, the Latitude of the Lizard, gives $37^{\circ} 54' N$. the other Latitude. By the two Latitudes, find the Meridional Diff. of Latitude by the 4th Problem.

To

To find the Difference of Longitude.

As Radius ————— 10.0000000

To the Meridional Difference of Latitude 1029 min. ——— 3.0124154

So is the Tang. of the Course $52^{\circ} 03'$ ——— 10.1079715

To the Difference of Longitude 1319 min. ——— 3.1203869

The Meridional Difference of Latitude in the Scale of Logarithmick Tangents, (omitting the three last Figures) is 1200, and the Angle that Rhumb makes with the Meridian, on which the Logarithmick Tangents become a Table of Diff. of Longitudes, is $51^{\circ} 38'$; from hence arises another Proportion to find the Diff. of Longitude. Co.Ar.

As the Tangent of this Logarithmick Rhumb $51^{\circ} 38'$ ——— 9.8985296

To the Merid. Diff. of Lat. in the Logarithmick Scale 1300 ——— 3.1139433

So the Tangent of the given Rhumb or Course $52^{\circ} 03'$ ——— 10.1079715

To the difference of Longitude required 1319 min. ——— 3.1204444

The Operation by Gunter's Scale. To find the Difference of Latitude.

The extent from the S. 90° , to the S. $37^{\circ} 57'$, the Comp. of the Course, shall reach from the Distance 1197, to the Difference of Latitude 736.

To find the Departure.

The extent from the S. 90° , to the S. of the Course $52^{\circ} 03'$, shall reach from the Distance 1197, to the Departure 943,

To find the Difference of Longitude.

The extent, the Tang. 45° , to the Tang. of the Course $52^{\circ} 03'$, shall reach from the Merid. Diff. of Lat. 1029, to the Diff. of Longitude 1319.

Or thus, The extent from the Tang. $51^{\circ} 38'$, to the Tang. of the Course $52^{\circ} 03'$, shall reach from 1300 to the Diff. of Longitude 1319.

P R O B. VIII.

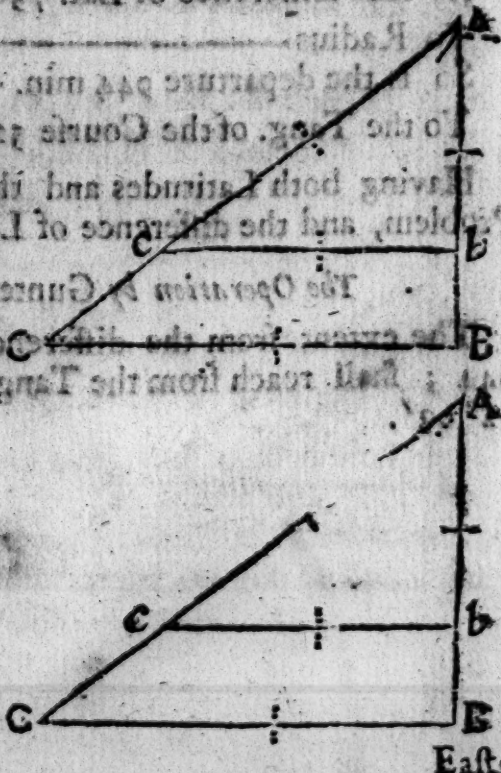
Both Latitudes, and the Course given, to find the Distance, the Departure and the Diff. of Longitude.

Examp. From the *Lizard*, in the Lat. $50^{\circ} 1' N.$ to the East-end of *St. Michael's*, the Course is S. $52^{\circ} 03' W.$ to find the Distance, the Departure and the Diff. of Longitude. Having both Latitudes and the Course, find the Distance and the Dep. by the 5th Prdb. and the Diff. of Long. by the 7th Prob.

P R O B. IX.

Both Latitudes and the Distance given, to find the Course, the Departure and the Difference of Longitude.

Example, The distance between the *Lizard*, in the Lat. $50^{\circ} 10' N.$ and the *East-*



The Operation by the Logarithms, To find the other Latitude

As the Tang. of the Course $52^{\circ} 03'$ 10.1079715
 To the difference of Longitude 1320 min. 3.1205739
 So is Radius 10.0000000

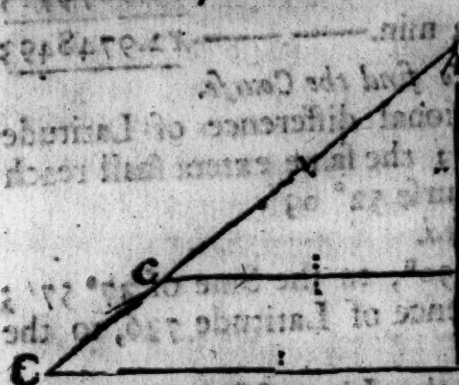
To the Meridian Difference of Lat. 1029 min. 3.0126024

Multiply 1029 by 1263, the Product 1299627, subtract from 10.4409029 the Tang. Comp. $19^{\circ} 55'$ (the half Comp. of $50^{\circ} 10'$), the remainder 10.3109402 is the Tang. Comp. of $26^{\circ} 03'$, the double whereof $52^{\circ} 06'$ subtracted from 90 deg. leaves the Latitude of the second place $37^{\circ} 54' N$.

Having both Latitudes and the Course, find the distance and departure, as in the 5th Problem.

The Operation by Gunter's Scale. To find the Meridional Diff. of Lat.

Extend the Compasses from the Tang. of the Course $52^{\circ} 03'$, to the Tang. of 45° ; the same extent shall reach from the Diff. of Longitude 1320, to the Meridional Diff. of Latitude 1029; by which find the other Latitude, as above.



PROB. VII.

One Latitude, the Course and Distance given, to find the other Latitude the Departure and the Difference of Longitude.

Examp. The Course from the Lizard in the Lat. $51^{\circ} 10' N$ is S. $52^{\circ} 03' W$. the Distance sailed 1197 min. to find the other Lat. the Dep. and the Diff. of Longitude.

The Operation by the Logarithms. To find the other Latitude.

As Radius 10.0000000
 To the Distance sailed 1197 min. 3.0780941
 So is the Sine Comp. of the Course $52^{\circ} 03'$ 9.7888565
 To the difference of Latitude 736 min. 12.8669506

To find the Departure.

As Radius 10.0000000
 To the Distance sailed 1197 min. 3.0780941
 So is Sine of the Course $52^{\circ} 03'$ 9.8968280
 To the Departure from the Meridian 943 min. 12.9749121

The Difference of Lat. 736 min. reduced into Degrees and Minutes, (dividing by 60) makes $12^{\circ} 16'$, which subtracted from the $50^{\circ} 10' N$, the Latitude of the Lizard, gives $37^{\circ} 54' N$. the other Latitude. By the two Latitudes, find the Meridional Diff. of Latitude by the 4th Problem.

To

To find the Difference of Longitude.

As Radius ————— 10.0000000

To the Meridional Difference of Latitude 1029 min. ——— 3.0124154

So is the Tang. of the Course $52^{\circ} 03'$ ——— 10.1079715

To the Difference of Longitude 1319 min. ——— 3.1203869

The Meridional Difference of Latitude in the Scale of Logarithmick Tangents, (omitting the three last Figures) is 1300, and the Angle that Rhumb makes with the Meridian, on which the Logarithmick Tangents become a Table of Diff. of Longitudes, is $51^{\circ} 38'$; from hence arises another Proportion to find the Diff. of Longitude. Co.Ar.

As the Tangent of this Logarithmick Rhumb $51^{\circ} 38'$ ——— 9.8985296

To the Merid. Diff. of Lat. in the Logarithmick Scale 1300 ——— 3.1139433

So the Tangent of the given Rhumb or Course $52^{\circ} 03'$ ——— 10.1079715

To the difference of Longitude required 1319 min. ——— 3.1204444

The Operation by Gunter's Scale. To find the Difference of Latitude.

The extent from the S. 90° , to the S. $37^{\circ} 57'$, the Comp. of the Course, shall reach from the Distance 1197, to the Difference of Latitude 736.

To find the Departure.

The extent from the S. 90° , to the S. of the Course $52^{\circ} 03'$, shall reach from the Distance 1197, to the Departure 943,

To find the Difference of Longitude.

The extent, the Tang. 45° , to the Tang. of the Course $52^{\circ} 03'$, shall reach from the Merid. Diff. of Lat. 1029, to the Diff. of Longitude 1319.

Or thus, The extent from the Tang. $51^{\circ} 38'$, to the Tang. of the Course $52^{\circ} 03'$, shall reach from 1300 to the Diff. of Longitude 1319.

P R O B. VIII.

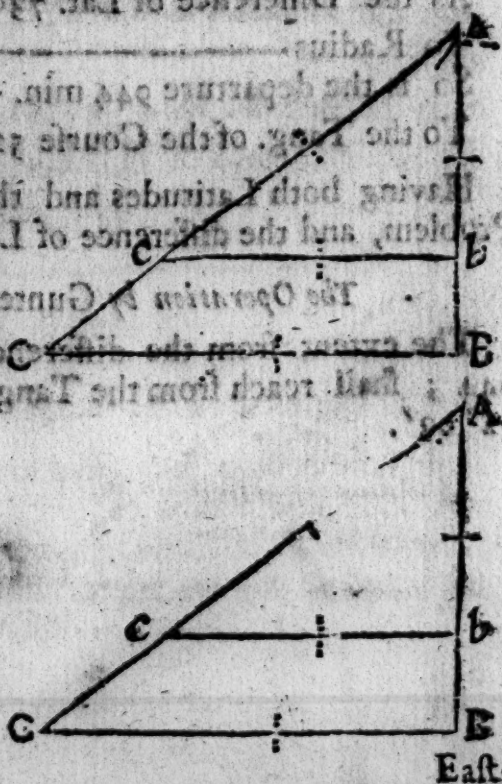
Both Latitudes, and the Course given, to find the Distance, the Departure and the Diff. of Longitude.

Examp. From the *Lizard*, in the Lat. $50^{\circ} 1' N.$ to the East-end of *St. Michael's*, the Course is S. $52^{\circ} 03' W.$ to find the Distance, the Departure and the Diff. of Longitude. Having both Latitudes and the Course, find the Distance and the Dep. by the 5th Prdb. and the Diff. of Long. by the 7th Prob.

P R O B. IX.

Both Latitudes and the Distance given, to find the Course, the Departure and the Difference of Longitude.

Example. The distance between the *Lizard*, in the Lat. $50^{\circ} 10' N.$ and the



East-end of St. Michael's, in the Lat. $37^{\circ} 54'$ N. is 1197 min. to find the Course, the Departure and Difference of Longitude.

The Operation by the Logarithms. To find the Course.

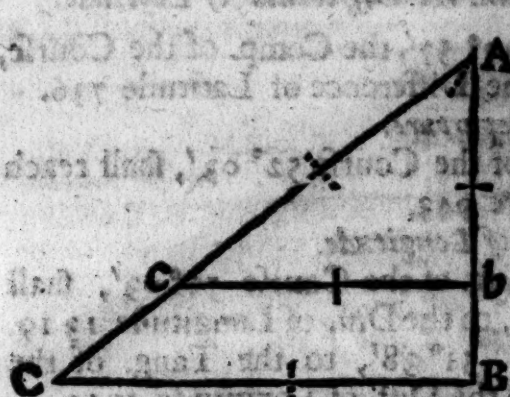
As the Difference of Latitude 736 min. ————— 2.8668778
 To Radius ————— 10.0000000
 So is the distance sailed 1197 min. ————— 2.9780941
 To the Secant of the Course $52^{\circ} 03'$ ————— 10.2112163

Having both Latitudes and the Course, find the Departure by the 5th Problem, and the difference of Longitude by the 7th Problem.

The Operation by Gunter's Scale. To find the Course.

The extent from the diff. of Lat. 736, to the distance 1197; shall reach from the S. 90° , to the S. $47^{\circ} 37'$; which represents the Secant of the Course $52^{\circ} 03'$, as was directed in the 5th Problem.

PROB. X.



Both Latitudes, and the departure given, to find the Course, the distance and the difference of Longitude.

Example. The Lizard in the Lat. $50^{\circ} 10'$ N. and the East-end of St. Michael's in the Lat. $37^{\circ} 54'$ N. the departure between them 944 min. to find the Course, the distance and difference of Longitude.

The Operation by the Logarithms. To find the Course.

As the Difference of Lat. 736 min. ————— 2.8668778
 To Radius ————— 10.0000000
 So is the departure 944 min. ————— 2.9749720
 To the Tang. of the Course $52^{\circ} 03'$ ————— 10.1080942

Having both Latitudes and the Course; find the distance by the 5th Problem, and the difference of Longitude by the 7th Problem.

The Operation by Gunter's Scale. To find the Course.

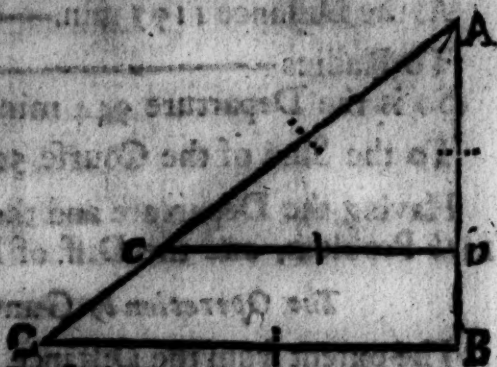
The extent from the difference of Latitude 736, to the departure 944; shall reach from the Tang. of 45 , to the Tang. of the Course $52^{\circ} 03'$.

PROB.

P R O B. XI.

One Latitude, the Course and the departure given, to find the other Latitude, the distance, and the diff. of Longitude.

Example The Course from the Lizard in the Lat. $50^{\circ} 10' N.$ being $S. 52^{\circ} 03' W.$ and the departure 944 min. to find the other Latitude, the distance and the difference of Longitude.



The Operation by the Logarithms, To find the other Latitude.

As the Tangent of the Course $52^{\circ} 03'$	10.1079715
To the departure 944 min.	2.9749720
So is Radius	10.0000000
To the difference of Lat. 736 min.	2.8670005

To find the Distance.

As the Sine of the Course $52^{\circ} 03'$	9.8968280
To the departure 944 min.	2.9749720
So is Radius	10.0000000
To the distance 1197 min.	3.0781440

Find the difference of Longitude as in the 7th Problem.

The Operation by Gunter's Scale. To find the Difference of Latitude.

The extent from the Tang. of the Course $52^{\circ} 03'$ to the Tang. of 45° , shall reach from the departure 944, to the difference of Latitude 736.

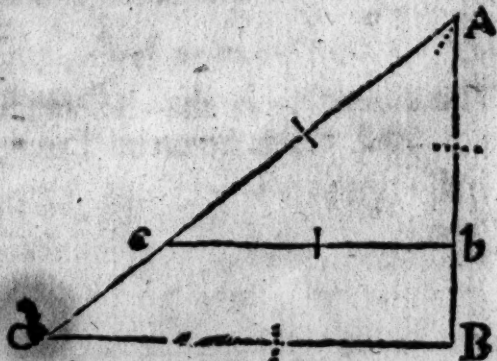
To find the distance.

The extent from the Sine of the Course $52^{\circ} 03'$ to the Sine of $90'$, shall reach from the departure 944, to the distance 1197.

P R O B. XII.

One Latitude, the distance and the departure given, to find the Course, the other Latitude and the difference of Longitude.

Example The distance from the Lizard in the Lat. $50^{\circ} 10' N.$ to another part bearing South westerly is 1197 minutes, and the Departure between them 944 min. to find the Course, the other Latitude and the difference of Longitude.



The

The Operation by the Logarithms. To find the Course.

As the Distance 1197 min. ————— 3.0789948

To Radius ————— 10.0000000

So is the Departure 944 min ————— 2.9749729

To the Sine of the Course $52^{\circ} 03'$ ————— 9.8968779

Having the Departure and the Courses, find the other Latitude by the 11th Problem, and the Diff. of Longitude by the 7th.

The Operation by Gunter's Scale. To find the Course.

The extent from the Distance 1197, to the Departure 944; shall reach from the Sine of 90° to the Sine of the Course $52^{\circ} 03'$.

PROB. XIII.

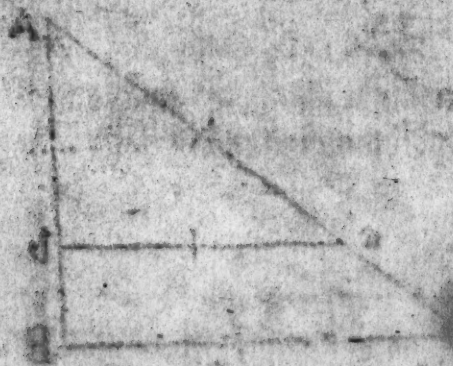
One Latitude, the distance and difference of Longitude given, to find the Course, the other Latitude and departure.

PROB. XIV.

One Latitude, the departure, and the Diff. of Longitude given, to find the Course, the other Latitude, and the Distance.

The Resolution of these two Problems are wanting, to compleat the Doctrine of *Mercator's Sailing*; and he that shall perform it, will have the Honour to make a further Improvement, in the Science of Geometry.

PROB. XII.



A Large and very Useful

T A B L E
O F
DIFFERENCE
O F
Latitude & Departure,
I N
Minutes and Tenth Parts,
to every *Degree and Quarter-Point*
O F T H E
C O M P A S S :
For the Exact Working
O F A
T R A V E R S E .

*London, Printed for B. Mout, at the Postern on
Tower-Hill.*

A Table of Difference

Diff.	1 Deg.		2 Deg.		$\frac{1}{4}$ Point.		3 Deg.		4 Deg.		5 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	01.0	00.0	01.0	00.0	01.0	00.0	01.0	00.0	01.0	00.1	01.0	00.1	1
2	02.0	00.0	02.0	00.1	02.0	00.1	02.0	00.1	02.0	00.1	02.0	00.2	2
3	03.0	00.1	03.0	00.1	03.0	00.1	03.0	00.2	03.0	00.2	03.0	00.3	3
4	04.0	00.1	04.0	00.1	04.0	00.2	04.0	00.2	04.0	00.3	04.0	00.3	4
5	05.0	00.1	05.0	00.2	05.0	00.2	05.0	00.3	05.0	00.3	05.0	00.4	5
6	06.0	00.1	06.0	00.2	06.0	00.3	06.0	00.3	06.0	00.4	06.0	00.5	6
7	07.0	00.1	07.0	00.2	07.0	00.3	07.0	00.4	07.0	00.5	07.0	00.6	7
8	08.0	00.1	08.0	00.3	08.0	00.4	08.0	00.4	08.0	00.6	08.0	00.7	8
9	09.0	00.2	09.0	00.3	09.0	00.4	09.0	00.5	09.0	00.6	09.0	00.8	9
10	10.0	00.2	10.0	00.4	10.0	00.5	10.0	00.5	10.0	00.7	10.0	00.9	10
11	11.0	00.2	11.0	00.4	11.0	00.5	11.0	00.6	11.0	00.8	11.0	01.0	11
12	12.0	00.2	12.0	00.4	12.0	00.6	12.0	00.6	12.0	00.8	12.0	01.0	12
13	13.0	00.2	13.0	00.5	13.0	00.6	13.0	00.7	13.0	00.9	13.0	01.1	13
14	14.0	00.2	14.0	00.5	14.0	00.7	14.0	00.7	14.0	01.0	14.0	01.2	14
15	15.0	00.3	15.0	00.5	15.0	00.7	15.0	00.8	15.0	01.0	15.0	01.3	15
16	16.0	00.3	16.0	00.6	16.0	00.8	16.0	00.8	16.0	01.1	16.0	01.4	16
17	17.0	00.3	17.0	00.6	17.0	00.8	17.0	00.9	17.0	01.2	17.0	01.5	17
18	18.0	00.3	18.0	00.6	18.0	00.9	18.0	00.9	18.0	01.3	18.0	01.6	18
19	19.0	00.3	19.0	00.7	19.0	00.9	19.0	01.0	19.0	01.3	19.0	01.7	19
20	20.0	00.4	20.0	00.7	20.0	01.0	20.0	01.0	20.0	01.4	20.0	01.7	20
21	21.0	00.4	21.0	00.7	21.0	01.0	21.0	01.1	21.0	01.5	21.0	01.8	21
22	22.0	00.4	22.0	00.8	22.0	01.1	22.0	01.1	22.0	01.5	22.0	01.9	22
23	23.0	00.4	23.0	00.8	23.0	01.1	23.0	01.2	23.0	01.6	23.0	02.0	23
24	24.0	00.4	24.0	00.8	24.0	01.2	24.0	01.3	24.0	01.7	24.0	02.1	24
25	25.0	00.4	25.0	00.9	25.0	01.2	25.0	01.3	25.0	01.7	25.0	02.2	25
26	26.0	00.5	26.0	00.9	26.0	01.3	26.0	01.4	26.0	01.8	26.0	02.3	26
27	27.0	00.5	27.0	00.9	27.0	01.3	27.0	01.4	27.0	01.9	27.0	02.4	27
28	28.0	00.5	28.0	01.0	28.0	01.4	28.0	01.5	28.0	02.0	28.0	02.4	28
29	29.0	00.5	29.0	01.0	29.0	01.4	29.0	01.5	29.0	02.0	29.0	02.5	29
30	30.0	00.5	30.0	01.1	30.0	01.5	30.0	01.6	30.0	02.1	30.0	02.6	30
31	31.0	00.5	31.0	01.1	31.0	01.5	31.0	01.6	31.0	02.2	31.0	02.7	31
32	32.0	00.6	32.0	01.1	32.0	01.6	32.0	01.7	32.0	02.2	32.0	02.8	32
33	33.0	00.6	33.0	01.2	33.0	01.6	33.0	01.7	33.0	02.3	33.0	02.9	33
34	34.0	00.6	34.0	01.2	34.0	01.7	34.0	01.8	34.0	02.4	34.0	03.0	34
35	35.0	00.6	35.0	01.2	35.0	01.7	35.0	01.8	35.0	02.4	35.0	03.1	35
36	36.0	00.6	36.0	01.3	36.0	01.8	36.0	01.9	36.0	02.5	36.0	03.1	36
37	37.0	00.7	37.0	01.3	37.0	01.8	37.0	01.9	37.0	02.6	37.0	03.2	37
38	38.0	00.7	38.0	01.3	38.0	01.9	38.0	02.0	38.0	02.7	38.0	03.3	38
39	39.0	00.7	39.0	01.4	39.0	01.9	39.0	02.0	39.0	02.7	39.0	03.4	39
40	40.0	00.7	40.0	01.4	40.0	02.0	40.0	02.1	40.0	02.8	40.0	03.5	40
41	41.0	00.7	41.0	01.4	41.0	02.0	41.0	02.1	41.0	02.9	41.0	03.6	41
42	42.0	00.7	42.0	01.5	42.0	02.1	42.0	02.2	42.0	02.9	42.0	03.7	42
43	43.0	00.8	43.0	01.5	43.0	02.1	43.0	02.2	43.0	03.0	43.0	03.8	43
44	44.0	00.8	44.0	01.5	44.0	02.2	44.0	02.3	44.0	03.1	44.0	03.8	44
45	45.0	00.8	45.0	01.6	45.0	02.2	45.0	02.4	45.0	03.1	45.0	03.9	45
46	46.0	00.8	46.0	01.6	46.0	02.2	46.0	02.4	46.0	03.2	46.0	04.0	46
47	47.0	00.8	47.0	01.6	47.0	02.3	47.0	02.5	47.0	03.3	47.0	04.1	47
48	48.0	00.8	48.0	01.7	48.0	02.3	48.0	02.5	48.0	03.4	48.0	04.2	48
49	49.0	00.9	49.0	01.7	49.0	02.4	49.0	02.6	49.0	03.4	49.0	04.3	49
50	50.0	00.9	50.0	01.8	50.0	02.4	50.0	02.6	50.0	03.5	50.0	04.4	50
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	89 Deg.	88 Deg.			74 Points		87 Deg.		86 Deg.		85 Deg.		

of Latitude and Departure.

99

Diff.	1 Deg.		2 Deg.		$\frac{1}{4}$ Point.		3 Deg.		4 Deg.		5 Deg.		Diff.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	51.0	00.9	51.0	01.8	50.9	01.5	50.9	02.7	50.9	03.6	50.8	04.4	51
52	52.0	00.9	52.0	01.8	51.9	02.5	51.9	02.7	51.9	03.6	51.8	04.5	52
53	53.0	00.9	53.0	01.8	52.9	02.6	52.9	02.8	52.9	03.7	52.8	04.6	53
54	54.0	00.9	54.0	01.9	53.9	02.6	53.9	02.8	53.9	03.8	53.8	04.7	54
55	55.0	01.0	55.0	01.9	54.9	02.7	54.9	02.9	54.9	03.8	54.8	04.8	55
56	56.0	01.0	56.0	02.0	55.9	02.7	55.9	02.9	55.9	03.9	55.8	04.9	56
57	57.0	01.0	57.0	02.0	56.9	02.8	56.9	03.0	56.9	04.0	56.8	05.0	57
58	58.0	01.0	58.0	02.0	57.9	02.8	57.9	03.0	57.9	04.1	57.8	05.1	58
59	59.0	01.0	59.0	02.1	58.9	02.9	58.9	03.1	58.8	04.1	58.8	05.2	59
60	60.0	01.0	60.0	02.1	59.9	02.9	59.9	03.1	59.8	04.2	59.8	05.2	60
61	61.0	01.1	61.0	02.1	60.9	03.0	60.9	03.2	60.8	04.3	60.8	05.3	61
62	62.0	01.1	62.0	02.2	61.9	03.0	61.9	03.3	61.8	04.3	61.8	05.4	62
63	63.0	01.1	63.0	02.2	62.9	03.1	62.9	03.3	62.8	04.4	62.8	05.5	63
64	64.0	01.1	64.0	02.2	63.9	03.1	63.9	03.4	63.8	04.5	63.8	05.6	64
65	65.0	01.1	65.0	02.3	64.9	03.2	64.9	03.4	64.8	04.5	64.7	05.7	65
66	66.0	01.1	66.0	02.3	65.9	03.2	65.9	03.5	65.8	04.6	65.7	05.8	66
67	67.0	01.2	67.0	02.3	66.9	03.3	66.9	03.5	66.8	04.7	66.7	05.9	67
68	68.0	01.2	67.9	02.4	67.9	03.3	67.9	03.6	67.8	04.8	67.7	05.9	68
69	69.0	01.2	68.9	02.4	68.9	03.4	68.9	03.6	68.8	04.8	68.7	06.0	69
70	70.0	01.2	69.9	02.4	69.9	03.4	69.9	03.7	69.8	04.9	69.7	06.1	70
71	71.0	01.2	70.9	02.5	70.9	03.5	70.9	03.7	70.8	05.0	70.7	06.2	71
72	72.0	01.3	71.9	02.5	71.9	03.5	71.9	03.8	71.8	05.0	71.7	06.3	72
73	73.0	01.3	72.9	02.5	72.9	03.6	72.9	03.8	72.8	05.1	72.7	06.4	73
74	74.0	01.3	73.9	02.6	73.9	03.6	73.9	03.9	73.8	05.2	73.7	06.5	74
75	75.0	01.3	74.9	02.6	74.9	03.7	74.9	03.9	74.8	05.2	74.7	06.6	75
76	76.0	01.3	75.9	02.7	75.9	03.7	75.9	04.0	75.8	05.3	75.7	06.6	76
77	77.0	01.3	76.9	02.7	76.9	03.8	76.9	04.0	76.8	05.4	76.7	06.7	77
78	78.0	01.4	77.9	02.7	77.9	03.8	77.9	04.1	77.8	05.5	77.7	06.8	78
79	79.0	01.4	78.9	02.8	78.9	03.9	78.9	04.1	78.8	05.5	78.7	06.9	79
80	80.0	01.4	79.9	02.8	79.9	03.9	79.9	04.2	79.8	05.6	79.7	07.0	80
81	81.0	01.4	80.9	02.8	80.9	04.0	80.9	04.2	80.8	05.7	80.7	07.1	81
82	82.0	01.4	81.9	02.9	81.9	04.0	81.9	04.3	81.8	05.7	81.7	07.2	82
83	83.0	01.4	82.9	02.9	82.9	04.1	82.9	04.4	82.8	05.8	82.7	07.3	83
84	84.0	01.5	83.9	02.9	83.9	04.1	83.9	04.4	83.8	05.9	83.7	07.3	84
85	85.0	01.5	84.9	03.0	84.9	04.2	84.9	04.5	84.8	05.9	84.7	07.4	85
86	86.0	01.5	85.9	03.0	85.9	04.2	85.9	04.5	85.8	06.0	85.7	07.5	86
87	87.0	01.5	86.9	03.0	86.9	04.3	86.9	04.6	86.8	06.1	86.7	07.5	87
88	88.0	01.5	87.9	03.1	87.9	04.3	87.9	04.6	87.8	06.2	87.7	07.7	88
89	89.0	01.5	88.9	03.1	88.9	04.4	88.9	04.7	88.8	06.2	88.7	07.8	89
90	90.0	01.6	89.9	03.1	89.9	04.4	89.9	04.7	89.8	06.3	89.7	07.9	90
91	91.0	01.6	90.9	03.2	90.9	04.5	90.9	04.8	90.8	06.4	90.7	08.0	91
92	92.0	01.6	91.9	03.2	91.9	04.5	91.9	04.8	91.8	06.4	91.6	08.0	92
93	93.0	01.6	92.9	03.2	92.9	04.6	92.9	04.9	92.8	06.5	92.6	08.1	93
94	94.0	01.6	93.9	03.3	93.9	04.6	93.9	04.9	93.8	06.6	93.6	08.2	94
95	95.0	01.6	94.9	03.3	94.9	04.7	94.9	05.0	94.8	06.6	94.6	08.3	95
96	96.0	01.7	95.9	03.4	95.9	04.7	95.9	05.0	95.8	06.7	95.6	08.4	96
97	97.0	01.7	96.9	03.4	96.9	04.8	96.9	05.1	96.8	06.8	96.6	08.5	97
98	98.0	01.7	97.9	03.4	97.9	04.8	97.9	05.1	97.8	06.9	97.6	08.6	98
99	99.0	01.7	98.9	03.5	98.9	04.9	98.9	05.2	98.8	06.9	98.6	08.7	99
100	100.0	01.7	99.9	03.5	99.9	04.9	99.9	05.2	99.8	07.0	99.6	08.7	100
Diff.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Diff.
	89 Deg.		88 Deg.		$7\frac{1}{4}$ Point.		87 Deg.		86 Deg.		85 Deg.		

A Table of Difference

Diff.	$\frac{1}{2}$ Point.		6 Deg.		7 Deg.		8 Deg.		$\frac{1}{4}$ Point.		9 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	01.0	00.1	01.0	00.1	01.0	00.1	01.0	00.1	01.0	00.1	01.0	00.2	1
2	02.0	00.2	02.0	00.2	02.0	00.2	02.0	00.3	02.0	00.3	02.0	00.3	2
3	03.0	00.3	03.0	00.3	03.0	00.4	03.0	00.4	03.0	00.4	03.0	00.5	3
4	04.0	00.4	04.0	00.4	04.0	00.5	04.0	00.6	04.0	00.6	04.0	00.6	4
5	05.0	00.5	05.0	00.5	05.0	00.6	05.0	00.7	05.0	00.7	05.0	00.8	5
6	06.0	00.6	06.0	00.6	06.0	00.7	06.0	00.8	06.0	00.8	06.0	00.9	6
7	07.0	00.7	07.0	00.7	06.9	00.8	06.9	01.0	06.9	01.0	06.9	01.1	7
8	08.0	00.8	08.0	00.8	07.9	01.0	07.9	01.1	07.9	01.2	07.9	01.2	8
9	09.0	00.9	08.9	00.9	08.9	01.1	08.9	01.2	08.9	01.3	08.9	01.4	9
10	09.9	01.0	09.9	01.0	09.9	01.2	09.9	01.4	09.9	01.5	09.9	01.6	10
11	10.9	01.1	10.9	01.1	10.9	01.3	10.9	01.5	10.9	01.6	10.9	01.7	11
12	11.9	01.2	11.9	01.2	11.9	01.5	11.9	01.7	11.9	01.8	11.8	01.9	12
13	12.9	01.3	12.9	01.4	12.9	01.6	12.9	01.8	12.9	01.9	12.8	02.0	13
14	13.9	01.4	13.9	01.5	13.9	01.7	13.9	01.9	13.8	02.1	13.8	02.2	14
15	14.9	01.5	14.9	01.6	14.9	01.8	14.8	02.1	14.8	02.2	14.8	02.3	15
16	15.9	01.6	15.9	01.7	15.9	01.9	15.8	02.2	15.8	02.3	15.8	02.5	16
17	16.9	01.7	16.9	01.8	16.9	02.1	16.8	02.4	16.8	02.5	16.8	02.7	17
18	17.9	01.8	17.9	01.9	17.9	02.2	17.8	02.5	17.8	02.6	17.8	02.8	18
19	18.9	01.9	18.9	02.0	18.9	02.3	18.8	02.6	18.8	02.8	18.8	03.0	19
20	19.9	02.0	19.9	02.1	19.8	02.4	19.8	02.8	19.8	02.9	19.7	03.1	20
21	20.9	02.1	20.9	02.2	20.8	02.6	20.8	02.9	20.8	03.1	20.7	03.3	21
22	21.9	02.2	21.9	02.3	21.8	02.7	21.8	03.1	21.8	03.2	21.7	03.4	22
23	22.9	02.2	22.9	02.4	22.8	02.8	22.8	03.2	22.7	03.4	22.7	03.6	23
24	23.9	02.3	23.9	02.5	23.8	02.9	23.8	03.3	23.7	03.5	23.7	03.8	24
25	24.9	02.4	24.9	02.6	24.8	03.0	24.8	03.5	24.7	03.7	24.7	03.9	25
26	25.9	02.5	25.9	02.7	25.8	03.2	25.7	03.6	25.7	03.8	25.7	04.1	26
27	26.9	02.6	26.9	02.8	26.8	03.3	26.7	03.7	26.7	04.0	26.7	04.2	27
28	27.9	02.7	27.8	02.9	27.8	03.4	27.7	03.9	27.7	04.1	27.6	04.4	28
29	28.9	02.8	28.8	03.0	28.8	03.5	28.7	04.0	28.7	04.2	28.6	04.5	29
30	29.8	02.9	29.8	03.1	29.8	03.7	29.7	04.2	29.7	04.4	29.6	04.7	30
31	30.8	03.0	30.8	03.2	30.8	03.8	30.7	04.3	30.7	04.5	30.6	04.9	31
32	31.8	03.1	31.8	03.3	31.8	03.9	31.7	04.4	31.6	04.7	31.6	05.0	32
33	32.8	03.2	32.8	03.4	32.7	04.0	32.7	04.6	32.6	04.8	32.6	05.2	33
34	33.8	03.3	33.8	03.5	33.7	04.1	33.7	04.7	33.6	05.0	33.6	05.3	34
35	34.8	03.4	34.8	03.7	34.7	04.3	34.7	04.9	34.6	05.1	34.6	05.5	35
36	35.8	03.5	35.8	03.8	35.7	04.4	35.6	05.0	35.6	05.3	35.5	05.6	36
37	36.8	03.6	36.8	03.9	36.7	04.5	36.6	05.1	36.6	05.4	36.5	05.8	37
38	37.8	03.7	37.8	04.0	37.7	04.6	37.6	05.3	37.6	05.6	37.5	06.0	38
39	38.8	03.8	38.8	04.1	38.7	04.8	38.6	05.4	38.6	05.7	38.5	06.1	39
40	39.8	03.9	39.8	04.2	39.7	04.9	39.6	05.6	39.6	05.9	39.5	06.3	40
41	40.8	04.0	40.8	04.3	40.7	05.0	40.6	05.7	40.6	06.0	40.5	06.4	41
42	41.8	04.1	41.8	04.4	41.7	05.1	41.6	05.8	41.5	06.2	41.5	06.6	42
43	42.8	04.2	42.8	04.5	42.7	05.2	42.6	06.0	42.5	06.3	42.5	06.7	43
44	43.8	04.3	43.7	04.6	43.7	05.4	43.6	06.1	43.5	06.5	43.5	06.9	44
45	44.8	04.4	44.7	04.7	44.7	05.5	44.6	06.3	44.5	06.6	44.4	07.0	45
46	45.8	04.5	45.7	04.8	45.7	05.6	45.6	06.4	45.5	06.7	45.4	07.2	46
47	46.8	04.6	46.7	04.9	46.6	05.7	46.5	06.5	46.5	06.9	46.4	07.3	47
48	47.8	04.7	47.7	05.0	47.6	05.9	47.5	06.7	47.5	07.0	47.4	07.5	48
49	48.8	04.8	48.7	05.1	48.6	06.0	48.5	06.8	48.5	07.2	48.4	07.7	49
50	49.8	04.9	49.7	05.2	49.6	06.1	49.5	07.0	49.5	07.3	49.4	07.8	50
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	7 $\frac{1}{2}$ Points		84 Deg.		83 Deg.		82 Deg.		7 $\frac{1}{4}$ Point.		81 Deg.		

101

Diff.	1/2 Point.		6 Deg.		7 Deg.		8 Deg.		1/4 Poi nt.		9 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	50.7	05.0	50.7	05.3	50.6	06.1	50.5	07.1	50.4	07.5	50.4	08.0	51
52	51.7	05.1	51.7	05.4	51.6	06.3	51.5	07.2	51.4	07.6	51.4	08.1	52
53	52.7	05.2	52.7	05.5	52.6	06.5	52.5	07.4	52.4	07.8	52.3	08.3	53
54	53.7	05.3	53.7	05.6	53.6	06.6	53.5	07.5	53.4	07.9	53.3	08.4	54
55	54.7	05.4	54.7	05.8	54.6	06.7	54.5	07.6	54.4	08.1	54.3	08.6	55
56	55.7	05.5	55.7	05.8	55.6	06.7	55.5	07.8	55.4	08.2	55.3	08.7	56
57	56.7	05.6	56.7	06.0	56.6	06.9	56.4	07.9	56.4	08.4	56.3	08.9	57
58	57.7	05.7	57.7	06.1	57.6	07.1	57.4	08.1	57.4	08.5	57.3	09.1	58
59	58.7	05.8	58.7	06.2	58.6	07.2	58.4	08.2	58.4	08.7	58.3	09.2	59
60	59.7	05.9	59.7	06.3	59.5	07.3	59.4	08.3	59.3	08.8	59.3	09.4	60
61	60.7	06.0	60.7	06.4	60.5	07.4	60.4	08.5	60.3	08.9	60.2	09.5	61
62	61.7	06.1	61.6	06.5	61.5	07.6	61.4	08.6	61.3	09.1	61.2	09.7	62
63	62.7	06.2	62.6	06.6	62.5	07.7	62.4	08.8	62.3	09.2	62.2	09.9	63
64	63.7	06.3	63.6	06.7	63.5	07.8	63.4	08.9	63.3	09.4	63.2	10.0	64
65	64.7	06.4	64.6	06.8	64.5	07.9	64.4	09.1	64.3	09.5	64.2	10.2	65
66	65.7	06.5	65.6	06.9	65.5	08.0	65.4	09.2	65.3	09.7	65.2	10.3	66
67	66.7	06.6	66.6	07.0	66.5	08.2	66.3	09.3	66.3	09.8	66.2	10.5	67
68	67.7	06.7	67.6	07.1	67.5	08.3	67.3	09.5	67.3	10.0	67.2	10.6	68
69	68.7	06.8	68.6	07.2	68.5	08.4	68.3	09.6	68.2	10.1	68.1	10.8	69
70	69.7	06.9	69.6	07.3	69.5	08.5	69.3	09.7	69.2	10.3	69.1	10.9	70
71	70.6	07.0	70.6	07.4	70.5	08.7	70.3	09.9	70.2	10.4	70.1	11.1	71
72	71.6	07.1	71.6	07.5	71.5	08.8	71.3	10.0	71.2	10.6	71.1	11.3	72
73	72.6	07.1	72.6	07.6	72.4	08.9	72.3	10.2	72.2	10.7	72.1	11.4	73
74	73.6	07.2	73.6	07.7	73.4	09.0	73.3	10.3	73.2	10.9	73.1	11.6	74
75	74.6	07.3	74.6	07.8	74.4	09.1	74.3	10.4	74.2	11.0	74.1	11.7	75
76	75.6	07.4	75.6	07.9	75.4	09.3	75.3	10.6	75.2	11.1	75.1	11.9	76
77	76.6	07.5	76.6	08.0	76.4	09.4	76.2	10.7	76.2	11.3	76.0	12.0	77
78	77.6	07.6	77.6	08.1	77.4	09.5	77.2	10.9	77.1	11.4	77.0	12.2	78
79	78.6	07.7	78.6	08.3	78.4	09.6	78.2	11.0	78.1	11.6	78.0	12.4	79
80	79.6	07.8	79.6	08.4	79.4	09.8	79.2	11.1	79.1	11.7	79.0	12.5	80
81	80.6	07.9	80.5	08.5	80.4	09.9	80.2	11.3	80.1	11.9	80.0	12.7	81
82	81.6	08.0	81.5	08.6	81.4	10.0	81.2	11.4	81.1	12.0	81.0	12.8	82
83	82.6	08.1	82.5	08.7	82.4	10.0	82.2	11.5	82.1	12.2	82.0	13.0	83
84	83.6	08.2	83.5	08.8	83.4	10.1	83.2	11.7	83.1	12.3	83.0	13.1	84
85	84.6	08.3	84.5	08.9	84.4	10.3	84.2	11.8	84.1	12.5	83.9	13.3	85
86	85.6	08.4	85.5	09.0	85.4	10.4	85.2	12.0	85.1	12.6	84.9	13.4	86
87	86.6	08.5	86.5	09.1	86.3	10.5	86.1	12.1	86.0	12.8	85.9	13.6	87
88	87.6	08.6	87.5	09.2	87.3	10.7	87.1	12.2	87.0	12.9	86.9	13.8	88
89	88.6	08.7	88.5	09.3	88.3	10.9	88.1	12.4	88.0	13.1	87.9	13.9	89
90	89.6	08.8	89.5	09.4	89.3	11.0	89.1	12.5	89.0	13.2	88.9	14.1	90
91	90.6	08.9	90.5	09.5	90.3	11.1	90.1	12.7	90.0	13.4	89.9	14.2	91
92	91.6	09.0	91.5	09.6	91.3	11.2	91.1	12.8	91.0	13.5	90.9	14.4	92
93	92.6	09.1	92.5	09.7	92.3	11.3	92.1	12.9	92.0	13.6	91.8	14.5	93
94	93.5	09.2	93.5	09.8	93.3	11.5	93.1	13.1	93.0	13.8	92.8	14.7	94
95	94.5	09.3	94.5	09.9	94.3	11.6	94.1	13.2	94.0	13.9	93.8	14.9	95
96	95.5	09.4	95.5	10.0	95.3	11.7	95.1	13.4	95.0	14.1	94.8	15.0	96
97	96.5	09.5	96.5	10.1	96.3	11.8	96.0	13.5	95.9	14.2	95.8	15.2	97
98	97.5	09.6	97.5	10.2	97.3	12.0	97.0	13.6	96.9	14.4	96.8	15.3	98
99	98.5	09.7	98.5	10.3	98.3	12.1	98.0	13.8	97.9	14.5	97.8	15.5	99
100	99.5	09.8	99.4	10.4	99.2	12.2	99.0	13.9	98.9	14.7	98.8	15.6	100
	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	7 1/2 Point.		84 Deg.		83 Deg.		82 Deg.		7 1/4 Point.		81 Deg.		

A Table of Difference

Diff.	10 Deg.		11 Deg.		1 Point.		12 Deg.		13 Deg.		14 Deg.		Diff.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	01.0	00.2	01.0	00.2	01.0	00.2	01.0	00.2	01.0	00.2	01.0	00.2	1
2	01.0	00.3	01.0	00.4	01.0	00.4	01.0	00.4	01.0	00.4	01.0	00.5	2
3	01.9	00.5	01.9	00.6	01.9	00.6	01.9	00.6	01.9	00.7	01.9	00.7	3
4	02.9	00.7	02.9	00.8	02.9	00.8	02.9	00.8	02.9	00.9	02.9	01.0	4
5	04.9	00.9	04.9	00.9	04.9	01.0	04.9	01.0	04.9	01.1	04.8	01.2	5
6	05.9	01.0	05.9	01.1	05.9	01.2	05.9	01.2	05.8	01.3	05.8	01.4	6
7	06.9	01.2	06.9	01.3	06.9	01.4	06.8	01.5	06.8	01.6	06.8	01.7	7
8	07.9	01.4	07.8	01.5	07.8	01.6	07.8	01.7	07.8	01.8	07.8	01.9	8
9	08.9	01.6	08.8	01.7	08.8	01.8	08.8	01.9	08.8	02.0	08.7	02.2	9
10	09.8	01.7	09.8	01.9	09.8	01.9	09.8	02.1	09.7	02.2	09.7	02.4	10
11	10.8	01.9	10.8	02.1	10.8	02.1	10.8	02.3	10.7	02.5	10.7	02.7	11
12	11.8	02.1	11.8	02.3	11.8	02.3	11.7	02.5	11.7	02.7	11.6	02.9	12
13	12.8	02.3	12.8	02.5	12.7	02.5	12.7	02.7	12.7	02.9	12.6	03.1	13
14	13.8	02.4	13.7	02.7	13.7	02.7	13.7	02.9	13.6	03.1	13.6	03.4	14
15	14.8	02.6	14.7	02.9	14.7	02.9	14.7	03.1	14.6	03.4	14.5	03.6	15
16	15.7	02.8	15.7	03.0	15.7	03.1	15.6	03.3	15.6	03.6	15.5	03.9	16
17	16.7	02.9	16.7	03.2	16.7	03.3	16.6	03.5	16.6	03.8	16.5	04.1	17
18	17.7	03.1	17.7	03.4	17.7	03.6	17.6	03.7	17.5	04.0	17.5	04.4	18
19	18.7	03.3	18.6	03.6	18.6	03.7	18.6	03.9	18.5	04.2	18.4	04.6	19
20	19.7	03.5	19.6	03.8	19.6	03.9	19.6	04.2	19.5	04.5	19.4	04.8	20
21	20.7	03.6	20.6	04.0	20.6	04.1	20.5	04.4	20.5	04.7	20.4	05.1	21
22	21.7	03.8	21.6	04.2	21.6	04.3	21.5	04.6	21.4	04.9	21.3	05.3	22
23	22.6	04.0	22.6	04.4	22.6	04.5	22.5	04.8	22.4	05.2	22.3	05.6	23
24	23.6	04.2	23.6	04.6	23.5	04.7	23.5	05.0	23.4	05.4	23.3	05.8	24
25	24.6	04.3	24.5	04.8	24.5	04.9	24.4	05.2	24.3	05.6	24.2	06.0	25
26	25.6	04.5	25.5	05.0	25.5	05.1	25.4	05.4	25.3	05.8	25.2	06.3	26
27	26.6	04.7	26.5	05.1	26.5	05.3	26.4	05.6	26.3	06.1	26.2	06.5	27
28	27.6	04.9	27.5	05.3	27.5	05.5	27.4	05.8	27.3	06.3	27.2	06.8	28
29	28.6	05.0	28.5	05.5	28.4	05.7	28.4	06.0	28.2	06.5	28.1	07.0	29
30	29.5	05.2	29.4	05.7	29.4	05.8	29.3	06.2	29.2	06.7	29.1	07.3	30
31	30.5	05.4	30.4	05.9	30.4	06.0	30.3	06.4	30.2	07.0	30.1	07.5	31
32	31.5	05.5	31.4	06.1	31.4	06.2	31.3	06.6	31.2	07.2	31.0	07.7	32
33	32.5	05.7	32.4	06.3	32.4	06.4	32.3	06.9	32.1	07.4	32.0	08.0	33
34	33.5	05.9	33.4	06.5	33.3	06.6	33.2	07.1	33.1	07.6	33.0	08.2	34
35	34.5	06.1	34.4	06.7	34.3	06.8	34.2	07.3	34.1	07.9	34.0	08.5	35
36	35.4	06.2	35.3	06.9	35.3	07.0	35.2	07.5	35.1	08.1	34.9	08.7	36
37	36.4	06.4	36.3	07.1	36.3	07.2	36.2	07.7	36.0	08.3	35.9	09.0	37
38	37.4	06.6	37.3	07.2	37.3	07.4	37.2	07.9	37.0	08.5	36.9	09.2	38
39	38.4	06.8	38.3	07.4	38.2	07.6	38.1	08.1	38.0	08.8	37.8	09.4	39
40	39.4	06.9	39.3	07.6	39.2	07.8	39.1	08.3	39.0	09.0	38.8	09.7	40
41	40.4	07.1	40.2	07.8	40.2	08.0	40.1	08.5	39.9	09.2	39.8	09.9	41
42	41.4	07.3	41.2	08.0	41.2	08.2	41.1	08.7	40.9	09.4	40.7	10.2	42
43	42.3	07.5	42.2	08.2	42.2	08.4	42.1	08.9	41.9	09.7	41.7	10.4	43
44	43.3	07.7	43.2	08.4	43.1	08.6	43.0	09.1	42.9	09.9	42.7	10.6	44
45	44.3	07.8	44.2	08.6	44.1	08.8	44.0	09.4	43.8	10.1	43.7	11.0	45
46	45.3	08.0	45.2	08.8	45.1	09.0	45.0	09.6	44.8	10.3	44.6	11.1	46
47	46.3	08.1	46.1	09.0	46.1	09.2	46.0	09.8	45.8	10.6	45.6	11.4	47
48	47.3	08.3	47.1	09.2	47.1	09.4	47.0	10.0	46.8	10.8	46.6	11.6	48
49	48.3	08.5	48.1	09.3	48.1	09.6	47.9	10.2	47.7	11.0	47.5	11.9	49
50	49.2	08.7	49.1	09.5	49.0	09.8	48.9	10.4	48.7	11.2	48.5	12.1	50
Diff.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Diff.
50	80 Deg.		79 Deg.		7 Points.		78 Deg.		77 Deg.		76 Deg.		Diff.

of Latitude and Departure

103

Diff.	10 Deg.		11 Deg.		1 Point.		12 Deg.		13 Deg.		14 Deg.		Diff.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	50.2	08.8	50.1	09.7	50.0	10.0	50.0	10.6	49.7	11.5	49.5	12.3	51
52	51.2	09.0	51.0	09.9	51.0	10.1	50.9	10.8	50.7	11.7	50.5	12.6	52
53	52.2	09.2	52.0	10.1	52.0	10.3	51.8	11.0	51.6	11.9	51.4	12.8	53
54	53.2	09.4	53.0	10.3	53.0	10.5	52.8	11.2	52.6	12.1	52.4	13.1	54
55	54.2	09.5	54.0	10.5	53.9	10.7	53.8	11.4	53.6	12.4	53.4	13.3	55
56	55.1	09.7	55.0	10.7	54.9	10.9	54.8	11.6	54.5	12.6	54.3	13.5	56
57	56.1	09.9	56.0	10.8	55.9	11.1	55.8	11.8	55.5	12.8	55.3	13.8	57
58	57.1	10.1	56.9	11.1	56.9	11.3	56.7	12.1	56.5	13.0	56.3	14.0	58
59	58.1	10.2	57.9	11.3	57.9	11.5	57.7	12.3	57.5	13.3	57.2	14.3	59
60	59.1	10.4	58.9	11.4	58.8	11.7	58.7	12.5	58.5	13.5	58.2	14.5	60
61	60.1	10.6	59.9	11.6	59.8	11.9	59.7	12.7	59.4	13.7	59.2	14.8	61
62	61.1	10.8	60.9	11.8	60.8	12.1	60.6	12.9	60.4	13.9	60.2	15.0	62
63	62.0	10.9	61.8	12.0	61.8	12.3	61.6	13.1	61.4	14.2	61.1	15.2	63
64	63.0	11.1	62.8	12.2	62.8	12.5	62.6	13.3	62.3	14.4	62.1	15.5	64
65	64.0	11.3	63.8	12.4	63.7	12.7	63.6	13.5	63.3	14.6	63.1	15.7	65
66	65.0	11.5	64.8	12.6	64.7	12.9	64.6	13.7	64.3	14.8	64.0	16.0	66
67	66.0	11.6	65.8	12.8	65.7	13.1	65.5	13.9	65.3	15.1	65.0	16.2	67
68	67.0	11.8	66.7	13.0	66.7	13.3	66.5	14.1	66.2	15.3	66.0	16.4	68
69	68.0	12.0	67.7	13.2	67.7	13.5	67.5	14.3	67.2	15.5	66.9	16.7	69
70	68.9	12.2	68.7	13.4	68.7	13.7	68.5	14.5	68.2	15.7	67.9	16.9	70
71	69.9	12.3	69.7	13.5	69.6	13.9	69.4	14.8	69.2	16.0	68.9	17.2	71
72	70.9	12.5	70.7	13.7	70.6	14.0	70.4	15.0	70.1	16.2	69.9	17.4	72
73	71.9	12.7	71.7	13.9	71.6	14.2	71.4	15.2	71.1	16.4	70.8	17.6	73
74	72.9	12.8	72.6	14.1	72.6	14.4	72.4	15.4	72.1	16.6	71.8	17.9	74
75	73.9	13.0	73.6	14.3	73.6	14.6	73.4	15.6	73.1	16.9	72.8	18.1	75
76	74.8	13.2	74.6	14.5	74.5	14.8	74.3	15.8	74.0	17.1	73.7	18.4	76
77	75.8	13.4	75.6	14.7	75.5	15.0	75.3	16.0	75.0	17.3	74.7	18.6	77
78	76.8	13.5	76.6	14.9	76.5	15.2	76.3	16.2	76.0	17.5	75.7	18.9	78
79	77.8	13.7	77.5	15.1	77.5	15.4	77.3	16.4	77.0	17.8	76.6	19.1	79
80	78.8	13.9	78.5	15.3	78.5	15.6	78.2	16.6	77.9	18.0	77.6	19.3	80
81	79.8	14.1	79.5	15.5	79.4	15.8	79.2	16.8	78.9	18.2	78.6	19.4	81
82	80.8	14.2	80.5	15.6	80.4	16.0	80.2	17.0	79.9	18.4	79.6	19.8	82
83	81.7	14.4	81.5	15.8	81.4	16.2	81.2	17.2	80.9	18.7	80.5	20.1	83
84	82.7	14.6	82.5	16.0	82.4	16.4	82.2	17.5	81.8	18.9	81.5	20.3	84
85	83.7	14.8	83.4	16.2	83.4	16.6	83.1	17.7	82.8	19.1	82.5	20.6	85
86	84.7	14.9	84.4	16.4	84.3	16.8	84.1	17.9	83.8	19.3	83.4	20.8	86
87	85.7	15.1	85.4	16.6	85.3	17.0	85.1	18.1	84.8	19.6	84.4	21.0	87
88	86.7	15.3	86.4	16.8	86.3	17.2	86.1	18.3	85.7	19.8	85.4	21.3	88
89	87.6	15.4	87.4	17.0	87.3	17.4	87.1	18.5	86.7	20.0	86.4	21.5	89
90	88.6	15.6	88.3	17.2	88.3	17.6	88.0	18.7	87.7	20.2	87.3	21.8	90
91	89.6	15.8	89.3	17.4	89.2	17.8	89.0	18.9	88.7	20.5	88.3	22.0	91
92	90.6	16.0	90.3	17.6	90.2	17.9	90.0	19.1	89.6	20.7	89.3	22.2	92
93	91.6	16.1	91.3	17.7	91.2	18.1	91.0	19.3	90.6	20.9	90.2	22.5	93
94	92.6	16.3	92.3	17.9	92.2	18.3	91.9	19.5	91.6	21.1	91.2	22.7	94
95	93.5	16.5	93.3	18.1	93.2	18.5	92.9	19.7	92.6	21.4	92.2	23.0	95
96	94.5	16.7	94.2	18.3	94.1	18.7	93.9	20.0	93.5	21.6	93.1	23.2	96
97	95.5	16.8	95.2	18.5	95.1	18.9	94.9	20.2	94.5	21.8	94.1	23.5	97
98	96.5	17.0	96.2	18.7	96.1	19.1	95.9	20.4	95.5	22.0	95.1	23.7	98
99	97.5	17.2	97.2	18.9	97.1	19.3	96.8	20.6	96.5	22.3	96.1	23.9	99
100	98.5	17.4	98.2	19.1	98.1	19.5	97.8	20.8	97.4	22.5	97.0	24.2	100
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	80 Deg.	79 Deg.			7 Points.		78 Deg.		77 Deg.		76 Deg.		

A Table of Difference

Difference	1 1/4 Deg.		1 1/2 Deg.		1 3/4 Deg.		1 1/2 Point.		1 7/8 Deg.		1 8/8 Deg.		Difference
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	01.0	00.2	01.0	00.3	01.0	00.3	01.0	00.3	01.0	00.3	00.9	00.3	1
2	01.9	00.5	01.9	00.5	01.9	00.5	01.9	00.6	01.9	00.6	01.9	00.6	2
3	02.9	00.7	02.9	00.8	02.9	00.8	02.9	00.9	02.9	00.9	02.8	00.9	3
4	03.9	01.0	03.9	01.0	03.8	01.1	03.8	01.2	03.8	01.2	03.8	01.2	4
5	04.8	01.2	04.8	01.3	04.8	01.4	04.8	01.5	04.8	01.5	04.8	01.5	5
6	05.8	01.5	05.8	01.5	05.8	01.6	05.8	01.7	05.7	01.7	05.7	01.8	6
7	06.8	01.7	06.8	01.8	06.8	01.9	06.8	02.0	06.7	02.0	06.7	02.2	7
8	07.8	01.9	07.7	02.1	07.7	02.2	07.7	02.3	07.6	02.3	07.6	02.5	8
9	08.7	02.2	08.7	02.3	08.6	02.5	08.6	02.6	08.6	02.6	08.6	02.8	9
10	09.7	02.4	09.7	02.6	09.6	02.8	09.6	02.9	09.6	02.9	09.5	03.1	10
11	10.7	02.8	10.6	02.8	10.6	03.0	10.5	03.2	10.5	03.2	10.5	03.4	11
12	11.6	02.9	11.6	03.1	11.5	03.3	11.5	03.5	11.5	03.5	11.4	03.7	12
13	12.6	03.2	12.6	03.4	12.5	03.6	12.4	03.8	12.4	03.8	12.4	04.0	13
14	13.6	03.4	13.5	03.6	13.5	03.9	13.4	04.1	13.4	04.1	13.3	04.3	14
15	14.5	03.6	14.5	03.9	14.4	04.1	14.4	04.4	14.3	04.4	14.3	04.6	15
16	15.5	04.0	15.5	04.1	15.4	04.4	15.3	04.6	15.3	04.7	15.2	04.9	16
17	16.5	04.1	16.4	04.4	16.3	04.7	16.3	04.9	16.3	05.0	16.2	05.2	17
18	17.5	04.4	17.4	04.7	17.3	05.0	17.2	05.2	17.2	05.3	17.1	05.6	18
19	18.4	04.6	18.4	04.9	18.3	05.2	18.2	05.5	18.2	05.5	18.1	05.9	19
20	19.4	04.9	19.3	05.2	19.2	05.5	19.1	05.8	19.1	05.8	19.0	06.2	20
21	20.4	05.1	20.3	05.4	20.2	05.8	20.1	06.1	20.1	06.1	20.0	06.5	21
22	21.3	05.3	21.2	05.7	21.1	06.1	21.0	06.4	21.0	06.4	20.9	06.8	22
23	22.3	05.6	22.2	06.0	22.1	06.3	22.0	06.7	22.0	06.7	21.9	07.1	23
24	23.3	05.8	23.2	06.2	23.1	06.6	23.0	06.8	22.9	07.0	22.8	07.4	24
25	24.2	06.0	24.1	06.5	24.0	06.9	23.9	07.3	23.9	07.3	23.8	07.7	25
26	25.2	06.3	25.1	06.7	24.9	07.2	24.9	07.5	24.9	07.6	24.7	08.0	26
27	26.2	06.6	26.1	07.0	25.9	07.4	25.8	07.8	25.8	07.9	25.7	08.3	27
28	27.2	06.8	27.0	07.2	26.9	07.7	26.8	08.1	26.8	08.2	26.6	08.6	28
29	28.1	07.0	28.0	07.5	27.8	08.0	27.8	08.4	27.7	08.5	27.6	09.0	29
30	29.1	07.3	29.0	07.8	28.8	08.3	28.7	08.7	28.7	08.8	28.5	09.3	30
31	30.1	07.5	29.9	08.0	29.8	08.5	29.7	09.0	29.6	09.1	29.5	09.6	31
32	31.0	07.9	30.9	08.3	30.7	08.8	30.6	09.3	30.6	09.3	30.4	10.0	32
33	32.0	08.0	31.9	08.5	31.7	09.1	31.6	09.6	31.6	09.6	31.4	10.2	33
34	33.0	08.3	32.8	08.8	32.7	09.4	32.5	09.9	32.5	09.9	32.3	10.5	34
35	33.9	08.5	33.8	09.0	33.6	09.6	33.5	10.2	33.5	10.2	33.3	10.8	35
36	34.9	08.7	34.8	09.3	34.6	09.9	34.4	10.4	34.4	10.5	34.2	11.1	36
37	35.9	09.0	35.7	09.6	35.6	10.2	35.4	10.7	35.4	10.8	35.2	11.4	37
38	36.9	09.2	36.7	09.8	36.5	10.5	36.4	11.0	36.3	11.1	36.1	11.7	38
39	37.8	09.5	37.7	10.1	37.5	10.7	37.3	11.3	37.3	11.4	37.1	12.0	39
40	38.8	09.7	38.6	10.3	38.4	11.0	38.3	11.6	38.2	11.7	38.0	12.4	40
41	39.8	10.0	39.6	10.6	39.4	11.3	39.2	11.9	39.2	12.0	39.0	12.7	41
42	40.7	10.2	40.6	10.9	40.4	11.5	40.2	12.2	40.2	12.3	39.9	13.0	42
43	41.7	10.4	41.5	11.1	41.3	11.8	41.1	12.5	41.1	12.6	40.9	13.3	43
44	42.7	10.7	42.5	11.5	42.3	12.1	42.1	12.8	42.1	12.9	41.8	13.6	44
45	43.6	10.9	43.5	11.6	43.2	12.4	43.1	13.1	43.0	13.1	42.8	13.9	45
46	44.6	11.2	44.4	11.9	44.2	12.7	44.0	13.3	44.0	13.4	43.7	14.2	46
47	45.6	11.4	45.4	12.2	45.2	12.9	45.0	13.6	44.9	13.7	44.7	14.5	47
48	46.6	11.7	46.4	12.4	46.1	13.2	45.9	13.9	45.9	14.0	45.6	14.8	48
49	47.5	11.9	47.3	12.7	47.1	13.5	46.9	14.2	46.9	14.3	46.6	15.1	49
50	48.5	12.1	48.3	12.9	48.1	13.8	47.8	14.5	47.8	14.6	47.5	15.4	50
Difference	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Difference
	6 1/4 Deg.		7 1/2 Deg.		7 3/4 Deg.		6 1/2 Point.		7 3/8 Deg.		7 2/8 Deg.		

of Latitude and Departure.

105

Diff.	1 $\frac{1}{4}$ Point.		15 Deg.		16 Deg.		1 $\frac{1}{2}$ Point.		17 Deg.		18 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	49.5	12.4	49.3	13.2	49.0	14.0	48.8	14.8	48.8	14.9	48.5	15.8	51
52	50.4	12.6	50.2	13.5	49.0	14.3	49.7	15.1	49.7	15.2	49.4	16.1	52
53	51.4	12.9	51.2	13.7	50.9	14.6	50.7	15.3	50.7	15.5	50.4	16.4	53
54	52.4	13.1	52.2	14.0	51.9	14.9	51.7	15.7	51.6	15.8	51.3	16.7	54
55	53.3	13.4	53.1	14.2	52.9	15.2	52.6	16.0	52.6	16.1	52.3	17.0	55
56	54.3	13.6	54.1	14.5	53.8	15.4	53.6	16.2	53.5	16.4	53.3	17.3	56
57	55.3	13.8	55.1	14.8	54.8	15.7	54.5	16.5	54.5	16.7	54.2	17.6	57
58	56.3	14.1	56.0	15.0	55.7	16.0	55.5	16.8	55.5	17.0	55.2	17.9	58
59	57.2	14.3	57.0	15.3	56.7	16.3	56.5	17.1	56.4	17.2	56.1	18.2	59
60	58.2	14.6	58.0	15.5	57.7	16.5	57.4	17.4	57.4	17.5	57.1	18.5	60
61	59.2	14.8	58.9	15.8	58.6	16.8	58.4	17.7	58.3	17.8	58.0	18.8	61
62	60.1	15.1	59.9	16.1	59.6	17.1	59.3	18.0	59.3	18.1	59.0	19.2	62
63	61.1	15.3	60.8	16.3	60.5	17.4	60.3	18.3	60.2	18.4	59.9	19.5	63
64	62.1	15.5	61.8	16.6	61.5	17.6	61.2	18.6	61.2	18.7	60.9	19.8	64
65	63.0	15.8	62.8	16.8	62.5	17.9	62.2	18.9	62.2	19.0	61.8	20.1	65
66	64.0	16.0	63.7	17.1	63.4	18.2	63.2	19.2	63.1	19.3	62.8	20.4	66
67	65.0	16.3	64.7	17.4	64.4	18.5	64.1	19.4	64.1	19.6	63.7	20.7	67
68	66.0	16.5	65.7	17.6	65.4	18.7	65.1	19.7	65.0	19.9	64.7	21.0	68
69	66.9	16.8	66.6	17.9	66.3	19.0	66.0	20.0	66.0	20.2	65.6	21.3	69
70	67.9	17.0	67.6	18.1	67.3	19.3	67.0	20.3	66.9	20.5	66.6	21.6	70
71	68.9	17.2	68.6	18.3	68.2	19.6	67.9	20.6	67.9	20.8	67.5	21.9	71
72	69.8	17.5	69.5	18.6	69.2	19.8	68.9	20.9	68.8	21.0	68.5	22.2	72
73	70.8	17.7	70.5	18.9	70.2	20.1	69.8	21.2	69.8	21.3	69.4	22.6	73
74	71.8	18.0	71.5	19.1	71.1	20.4	70.8	21.5	70.8	21.6	70.4	22.9	74
75	72.7	18.2	72.4	19.4	72.1	20.7	71.8	21.8	71.7	21.9	71.3	23.2	75
76	73.7	18.5	73.4	19.7	73.0	20.9	72.7	22.1	72.7	22.2	72.3	23.5	76
77	74.7	18.7	74.4	19.9	74.0	21.2	73.7	22.3	73.6	22.5	73.2	23.8	77
78	75.7	18.9	75.3	20.2	75.0	21.5	74.6	22.6	74.6	22.8	74.2	24.1	78
79	76.6	19.2	76.3	20.4	75.9	21.8	75.6	22.9	75.5	23.1	75.1	24.4	79
80	77.6	19.4	77.3	20.7	76.9	22.0	76.6	23.2	76.5	23.4	76.1	24.7	80
81	78.6	19.7	78.2	21.0	77.9	22.3	77.5	23.5	77.5	23.7	77.0	25.0	81
82	79.5	19.9	79.2	21.2	78.8	22.6	78.5	23.8	78.4	24.0	78.0	25.3	82
83	80.5	20.3	80.2	21.5	79.8	22.9	79.4	24.1	79.4	24.3	78.9	25.6	83
84	81.5	20.4	81.1	21.7	80.8	23.1	80.4	24.4	80.3	24.5	79.9	26.0	84
85	82.4	20.7	82.1	22.0	81.7	23.4	81.3	24.7	81.3	24.8	80.8	26.3	85
86	83.4	20.9	83.1	22.3	82.7	23.7	82.3	25.0	82.2	25.1	81.8	26.6	86
87	84.4	21.1	84.0	22.5	83.6	24.0	83.3	25.2	83.2	25.4	82.7	26.9	87
88	85.4	21.4	85.0	22.8	84.6	24.2	84.2	25.5	84.1	25.7	83.7	27.2	88
89	86.3	21.6	86.0	23.0	85.6	24.5	85.2	25.8	85.1	26.0	84.6	27.5	89
90	87.3	21.9	86.9	23.3	86.5	24.8	86.1	26.1	86.1	26.3	85.6	27.8	90
91	88.3	22.1	87.9	23.5	87.5	25.1	87.1	26.4	87.0	26.6	86.5	28.1	91
92	89.2	22.4	88.9	23.8	88.4	25.3	88.0	26.7	88.0	26.9	87.5	28.4	92
93	90.2	22.6	89.8	24.1	89.4	25.6	89.0	27.0	88.9	27.2	88.4	28.7	93
94	91.2	22.8	90.8	24.3	90.4	25.9	90.0	27.3	89.9	27.5	89.4	29.0	94
95	92.1	23.1	91.8	24.6	91.3	26.2	90.9	27.6	90.8	27.8	90.3	29.3	95
96	93.1	23.3	92.7	24.8	92.3	26.4	91.9	27.9	91.8	28.1	91.3	29.7	96
97	94.1	23.6	93.7	25.1	93.2	26.7	92.8	28.2	92.8	28.4	92.3	30.0	97
98	95.1	23.8	94.7	25.4	94.2	27.0	93.8	28.4	93.7	28.6	93.2	30.3	98
99	96.0	24.1	95.6	25.6	95.2	27.3	94.7	28.7	94.7	28.9	94.2	30.6	99
100	97.0	24.3	96.6	25.9	96.1	27.6	95.7	29.0	95.6	29.2	95.1	30.9	100
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
6 $\frac{1}{4}$ Point.	75 Deg.	74 Deg.	6 $\frac{1}{2}$ Point.	73 Deg.	72 Deg.								

A Table of Difference

Diff.	19 Deg.		1 $\frac{3}{4}$ Point.		20 Deg.		21 Deg.		22 Deg.		2 Points.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.9	00.3	00.9	00.3	00.9	00.3	00.9	00.4	00.9	00.4	00.9	00.4	1
2	01.9	00.6	01.9	00.7	01.9	00.7	01.9	00.7	01.8	00.7	01.8	00.8	2
3	02.8	01.0	02.8	01.0	02.8	01.0	02.8	01.1	02.8	01.1	02.8	01.1	3
4	03.8	01.3	03.8	01.3	03.8	01.4	03.7	01.4	03.7	01.5	03.7	01.5	4
5	04.7	01.6	04.7	01.7	04.7	01.7	04.7	01.8	04.6	01.9	04.6	01.9	5
6	05.7	01.9	05.6	02.0	05.6	02.0	05.6	02.1	05.6	02.2	05.5	02.3	6
7	06.6	02.3	06.6	02.4	06.6	02.4	06.5	02.5	06.5	02.6	06.5	02.7	7
8	07.6	02.6	07.5	02.7	07.5	02.7	07.5	02.9	07.4	03.0	07.4	03.1	8
9	08.5	02.9	08.5	03.0	08.5	03.1	08.4	03.2	08.3	03.4	08.3	03.4	9
10	09.5	03.3	09.4	03.4	09.4	03.4	09.3	03.6	09.3	03.7	09.2	03.8	10
11	10.4	03.6	10.4	03.7	10.3	03.8	10.3	03.9	10.2	04.1	10.2	04.2	11
12	11.3	03.9	11.3	04.0	11.3	04.1	11.2	04.3	11.1	04.5	11.1	04.6	12
13	12.3	04.2	12.2	04.4	12.2	04.4	12.1	04.7	12.0	04.9	12.0	05.0	13
14	13.2	04.6	13.2	04.7	13.2	04.8	13.1	05.0	13.0	05.2	12.9	05.4	14
15	14.2	04.9	14.1	05.1	14.1	05.1	14.0	05.4	13.9	05.6	13.9	05.7	15
16	15.1	05.2	15.1	05.4	15.0	05.4	14.9	05.7	14.8	06.0	14.8	06.1	16
17	16.1	05.5	16.0	05.7	16.0	05.8	15.9	06.1	15.8	06.4	15.7	06.5	17
18	17.0	05.9	16.9	06.1	16.9	06.3	16.8	06.4	16.7	06.7	16.6	06.8	18
19	18.0	06.1	17.9	06.4	17.9	06.5	17.7	06.8	17.6	07.1	17.6	07.3	19
20	18.9	06.5	18.9	06.7	18.8	06.8	18.7	07.2	18.5	07.5	18.5	07.6	20
21	19.9	06.8	19.8	07.1	19.7	07.2	19.6	07.5	19.5	07.9	19.4	08.0	21
22	20.8	07.2	20.7	07.4	20.7	07.5	20.5	07.9	20.4	08.2	20.3	08.4	22
23	21.7	07.5	21.7	07.7	21.6	07.9	21.5	08.2	21.3	08.6	21.2	08.8	23
24	22.7	07.8	22.6	08.1	22.5	08.2	22.4	08.6	22.2	09.0	22.2	09.2	24
25	23.6	08.1	23.5	08.4	23.5	08.5	23.3	09.0	23.2	09.4	23.1	09.6	25
26	24.6	08.5	24.5	08.8	24.4	08.9	24.3	09.3	24.1	09.7	24.0	09.9	26
27	25.5	08.8	25.4	09.1	25.4	09.2	25.2	09.7	25.0	10.1	24.9	10.3	27
28	26.5	09.1	26.4	09.4	26.3	09.6	26.1	10.0	26.0	10.5	25.9	10.7	28
29	27.4	09.4	27.3	09.8	27.2	09.9	27.1	10.4	26.9	10.9	26.8	11.1	29
30	28.4	09.8	28.2	10.1	28.2	10.3	28.0	10.7	27.8	11.2	27.7	11.5	30
31	29.3	10.1	29.2	10.4	29.1	10.6	28.9	11.1	28.7	11.6	28.6	11.9	31
32	30.3	10.4	30.1	10.8	30.1	10.9	29.1	11.5	29.7	12.0	29.6	12.2	32
33	31.2	10.7	31.1	11.1	31.0	11.3	30.8	11.8	30.6	12.4	30.5	12.6	33
34	32.1	11.1	32.0	11.5	31.9	11.6	31.7	12.2	31.5	12.7	31.4	13.0	34
35	33.1	11.4	33.0	11.8	32.9	12.0	32.7	12.5	32.4	13.1	32.3	13.4	35
36	34.0	11.7	33.9	12.1	33.8	12.3	33.6	12.9	33.4	13.5	33.3	13.8	36
37	35.0	12.1	34.8	12.5	34.8	12.5	34.5	13.3	34.3	13.9	34.2	14.2	37
38	35.9	12.4	35.8	12.8	35.7	13.0	35.5	13.6	35.2	14.2	35.1	14.5	38
39	36.9	12.6	36.7	13.1	36.6	13.3	36.4	14.0	36.2	14.6	36.0	14.9	39
40	37.8	13.0	37.7	13.5	37.6	13.7	37.3	14.3	37.1	15.0	36.9	15.3	40
41	38.8	13.3	38.6	13.8	38.5	14.0	38.3	14.7	38.0	15.3	37.9	15.7	41
42	39.7	13.7	39.5	14.1	39.5	14.4	39.2	15.1	38.9	15.7	38.8	16.1	42
43	40.7	14.0	40.5	14.5	40.4	14.7	40.1	15.4	39.9	16.1	39.7	16.5	43
44	41.6	14.3	41.4	14.8	41.3	15.0	41.1	15.8	40.8	16.5	40.6	16.8	44
45	42.6	14.6	42.4	15.2	42.3	15.4	42.0	16.1	41.7	16.8	41.6	17.2	45
46	43.5	15.0	43.3	15.5	43.2	15.7	42.9	16.5	42.6	17.2	42.5	17.6	46
47	44.4	15.3	44.2	15.8	44.2	16.1	43.9	16.8	43.6	17.6	43.4	18.0	47
48	45.4	15.6	45.2	16.2	45.1	16.4	44.8	17.2	44.5	18.0	44.3	18.4	48
49	46.3	15.9	46.1	16.5	46.0	16.8	45.7	17.6	45.4	18.3	45.3	18.7	49
50	47.3	16.3	47.1	16.8	47.0	17.1	46.7	17.9	46.4	18.7	46.2	19.1	50
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	71 Deg.	6 $\frac{1}{4}$ Point.	70 Deg.	69 Deg.	68 Deg.	6 Points.							

of Latitude and Departure.

107

Diff.	19 Deg. 1 $\frac{1}{4}$ Point.				20 Deg.				21 Deg.				22 Deg.				2 Points.				Diff.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	48.2	16.6	48.0	17.2	47.9	17.4			47.6	18.3	47.3	19.1	47.1	19.5			47.1	19.5			51
52	49.2	16.9	49.0	17.5	48.9	17.8			48.5	18.6	48.2	19.4	48.0	19.9			48.0	19.9			52
53	50.1	17.3	49.9	17.9	49.8	18.1			49.5	19.0	49.1	19.8	49.0	20.3			49.0	20.3			53
54	51.1	17.6	50.8	18.2	50.7	18.5			50.4	19.3	50.1	20.2	49.9	20.7			49.9	20.7			54
55	52.0	17.9	51.8	18.5	51.7	18.8			51.3	19.7	51.0	20.6	50.8	21.0			50.8	21.0			55
56	52.9	18.2	52.7	18.9	52.6	19.2			52.3	20.1	51.9	21.0	51.7	21.4			51.7	21.4			56
57	53.9	18.6	53.7	19.2	53.6	19.5			53.2	20.4	52.8	21.3	52.7	21.8			52.7	21.8			57
58	54.8	18.9	54.6	19.5	54.5	19.8			54.1	20.8	53.8	21.7	53.6	22.2			53.6	22.2			58
59	55.8	19.2	55.5	19.9	55.4	20.2			55.1	21.1	54.7	22.1	54.5	22.6			54.5	22.6			59
60	56.7	19.5	56.5	20.2	56.4	20.5			56.0	21.5	55.6	22.5	55.4	23.0			55.4	23.0			60
61	57.7	19.9	57.4	20.5	57.3	20.9			56.9	21.9	56.5	22.8	56.3	23.3			56.3	23.3			61
62	58.6	20.2	58.4	20.9	58.3	21.2			57.9	22.2	57.5	23.2	57.3	23.7			57.3	23.7			62
63	59.6	20.5	59.3	21.2	59.2	21.5			58.8	22.6	58.4	23.6	58.2	24.1			58.2	24.1			63
64	60.5	20.8	60.3	21.6	60.1	21.9			59.7	22.9	59.3	24.0	59.1	24.5			59.1	24.5			64
65	61.5	21.2	61.2	21.9	61.1	22.2			60.7	23.3	60.3	24.3	60.0	24.9			60.0	24.9			65
66	62.4	21.5	62.1	22.2	62.0	22.6			61.6	23.6	61.2	24.7	61.0	25.3			61.0	25.3			66
67	63.3	21.8	63.1	22.6	63.0	22.9			62.5	24.0	62.1	25.1	61.9	25.6			61.9	25.6			67
68	64.3	22.1	64.0	22.9	63.9	23.3			63.5	24.4	63.0	25.5	62.8	26.0			62.8	26.0			68
69	65.2	22.5	65.0	23.2	64.8	23.6			64.4	24.7	64.0	25.8	63.7	26.4			63.7	26.4			69
70	66.2	22.8	65.9	23.6	65.8	23.9			65.3	25.1	64.9	26.2	64.7	26.8			64.7	26.8			70
71	67.1	23.1	66.8	23.9	66.7	24.3			66.3	25.4	65.8	26.6	65.6	27.2			65.6	27.2			71
72	68.1	23.4	67.8	24.2	67.7	24.6			67.2	25.8	66.7	27.0	66.5	27.6			66.5	27.6			72
73	69.0	23.8	68.7	24.6	68.6	25.0			68.1	26.2	67.7	27.3	67.4	27.9			67.4	27.9			73
74	70.0	24.1	69.7	24.9	69.5	25.3			69.1	26.5	68.6	27.7	68.4	28.3			68.4	28.3			74
75	70.9	24.4	70.6	25.3	70.5	25.6			70.0	26.9	69.5	28.1	69.3	28.7			69.3	28.7			75
76	71.9	24.7	71.6	25.6	71.4	26.0			70.9	27.2	70.5	28.5	70.2	29.1			70.2	29.1			76
77	72.8	25.1	72.5	25.9	72.4	26.3			71.9	27.6	71.4	28.8	71.1	29.5			71.1	29.5			77
78	73.7	25.4	73.4	26.3	73.3	26.7			72.8	27.9	72.3	29.2	72.1	29.8			72.1	29.8			78
79	74.7	25.7	74.4	26.6	74.2	27.0			73.7	28.3	73.2	29.6	73.0	30.2			73.0	30.2			79
80	75.6	26.0	75.3	26.9	75.2	27.4			74.7	28.7	74.2	30.0	73.9	30.6			73.9	30.6			80
81	76.6	26.4	76.3	27.3	76.1	27.7			75.6	29.0	75.1	30.3	74.8	31.0			74.8	31.0			81
82	77.5	26.7	77.2	27.6	77.1	28.0			76.5	29.4	76.0	30.7	75.8	31.4			75.8	31.4			82
83	78.5	27.0	78.1	28.0	78.0	28.4			77.5	29.7	76.9	31.1	76.7	31.8			76.7	31.8			83
84	79.4	27.3	79.1	28.3	78.9	28.7			78.4	30.1	77.9	31.5	77.6	32.1			77.6	32.1			84
85	80.4	27.7	80.1	28.6	79.9	29.1			79.3	30.5	78.8	31.8	78.6	32.5			78.6	32.5			85
86	81.3	28.0	81.0	29.0	80.8	29.4			80.3	30.8	79.7	32.2	79.4	32.9			79.4	32.9			86
87	82.3	28.3	81.9	29.3	81.8	29.7			81.2	31.2	80.7	32.6	80.4	33.3			80.4	33.3			87
88	83.2	28.6	82.8	29.6	82.7	30.1			82.1	31.5	81.6	33.0	81.3	33.7			81.3	33.7			88
89	84.1	29.0	83.8	30.0	83.6	30.4			83.1	31.9	82.5	33.3	82.2	34.1			82.2	34.1			89
90	85.1	29.3	84.7	30.3	84.6	30.8			84.0	32.3	83.4	33.7	83.1	34.4			83.1	34.4			90
91	86.0	29.6	85.7	30.7	85.5	31.1			84.9	32.6	84.4	34.1	84.1	34.8			84.1	34.8			91
92	87.0	29.9	86.6	31.0	86.4	31.5			85.9	33.0	85.3	34.5	85.0	35.2			85.0	35.2			92
93	88.0	30.3	87.6	31.3	87.4	31.8			86.8	33.3	86.2	34.8	85.9	35.6			85.9	35.6			93
94	88.9	30.6	88.5	31.7	88.3	32.1			87.7	33.7	87.2	35.2	86.8	36.0			86.8	36.0			94
95	89.8	30.9	89.4	32.0	89.3	32.5			88.7	34.0	88.1	35.6	87.8	36.3			87.8	36.3			95
96	90.8	31.3	90.4	32.3	90.2	32.8			89.6	34.4	89.0	35.9	88.7	36.7			88.7	36.7			96
97	91.7	31.6	91.3	32.7	91.1	33.2			90.5	34.8	89.9	36.3	89.6	37.1			89.6	37.1			97
98	92.7	31.9	92.3	33.0	92.1	33.5			91.5	35.1	90.9	36.7	90.5	37.5			90.5	37.5			98
99	93.6	32.2	93.2	33.3	93.0	33.9			92.4	35.5	91.8	37.1	91.5	37.9			91.5	37.9			99
100	94.5	32.6	94.2	33.7	94.0	34.2			93.4	35.8	92.7	37.5	92.4	38.3			92.4	38.3			100
Diff.	17 Deg. 6 $\frac{1}{4}$ Point.				70 Deg.				69 Deg.				68 Deg.				6 Points.				Diff.
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	

A Table of Difference.

Diff.	23 Deg.		24 Deg.		25 Deg.		2½ Point.		26 Deg.		27 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.9	00.4	00.9	00.4	00.9	00.4	00.9	00.4	00.9	00.4	00.9	00.4	1
2	01.8	00.8	01.8	00.8	01.8	00.8	01.8	00.9	01.8	00.9	01.8	00.9	2
3	02.8	01.2	02.7	01.2	02.7	01.3	02.7	01.3	02.7	01.3	02.7	01.4	3
4	03.7	01.6	03.6	01.6	03.6	01.7	03.6	01.7	03.6	01.7	03.6	01.8	4
5	04.6	01.9	04.6	02.0	04.5	02.1	04.5	02.1	04.5	02.2	04.5	02.3	5
6	05.5	02.3	05.5	02.4	05.4	02.5	05.4	02.6	05.4	02.6	05.3	02.7	6
7	06.4	02.7	06.4	02.8	06.3	03.0	06.3	03.0	06.3	03.1	06.2	03.2	7
8	07.4	03.1	07.3	03.2	07.2	03.4	07.2	03.4	07.2	03.5	07.1	03.6	8
9	08.3	03.5	08.2	03.7	08.0	03.8	08.1	03.8	08.1	03.9	08.0	04.1	9
10	09.2	03.9	09.1	04.1	09.1	04.2	09.0	04.3	09.0	04.4	08.9	04.5	10
11	10.1	04.3	10.0	04.5	10.0	04.6	09.9	04.7	09.9	04.8	09.8	05.0	11
12	11.0	04.7	11.0	04.9	10.9	05.1	10.8	05.1	10.8	05.3	10.7	05.4	12
13	12.0	05.1	11.9	05.3	11.8	05.5	11.7	05.6	11.7	05.7	11.6	05.8	13
14	12.9	05.5	12.8	05.7	12.7	05.9	12.7	05.9	12.6	06.1	12.5	06.4	14
15	13.8	05.9	13.7	06.1	13.6	06.3	13.6	06.4	13.5	06.6	13.4	06.8	15
16	14.7	06.2	14.6	06.5	14.5	06.8	14.5	06.6	14.4	07.0	14.3	07.3	16
17	15.6	06.6	15.5	06.9	15.4	07.2	15.4	07.3	15.3	07.4	15.1	07.7	17
18	16.6	07.0	16.4	07.3	16.3	07.6	16.3	07.7	16.2	07.9	16.0	08.2	18
19	17.5	07.4	17.4	07.7	17.2	08.0	17.2	08.1	17.1	08.3	16.9	08.6	19
20	18.4	07.8	18.3	08.1	18.1	08.4	18.1	08.5	18.0	08.8	17.8	09.1	20
21	19.3	08.2	19.2	08.5	19.0	08.9	19.0	09.0	18.9	09.2	18.7	09.5	21
22	20.2	08.6	20.1	08.9	19.9	09.3	19.9	09.4	19.8	09.9	19.6	10.0	22
23	21.2	09.0	21.0	09.3	20.8	09.7	20.8	09.8	20.7	10.1	20.5	10.4	23
24	22.1	09.4	21.9	09.8	21.7	10.1	21.7	10.3	21.6	10.5	21.4	10.9	24
25	23.0	09.8	22.8	10.2	22.7	10.6	22.6	10.7	22.5	11.0	22.3	11.3	25
26	23.9	10.2	23.7	10.6	23.6	11.0	23.5	11.1	23.4	11.4	23.2	11.8	26
27	24.8	10.5	24.7	11.0	24.5	11.4	24.4	11.5	24.3	11.8	24.1	12.3	27
28	25.8	10.9	25.6	11.4	25.4	11.8	25.3	12.0	25.2	12.3	24.9	12.7	28
29	26.7	11.3	26.5	11.8	26.3	12.3	26.2	12.4	26.1	12.7	25.8	13.2	29
30	27.6	11.7	27.4	12.2	27.2	12.7	27.1	12.8	27.0	13.1	26.7	13.6	30
31	28.5	12.1	28.3	12.6	28.1	13.1	28.0	13.3	27.9	13.6	27.6	14.1	31
32	29.5	12.5	29.2	13.0	29.0	13.5	28.9	13.7	28.7	14.0	28.5	14.5	32
33	30.4	12.9	30.1	13.4	29.9	13.9	29.8	14.1	29.6	14.4	29.4	15.0	33
34	31.3	13.3	31.1	13.8	30.8	14.4	30.7	14.5	30.6	14.9	30.3	15.4	34
35	32.2	13.7	32.0	14.2	31.7	14.8	31.6	15.0	31.5	15.3	31.2	15.9	35
36	33.1	14.1	32.9	14.6	32.6	15.2	32.5	15.4	32.4	15.8	32.1	16.3	36
37	34.1	14.4	33.8	15.0	33.5	15.6	33.4	15.8	33.2	16.2	33.0	16.8	37
38	35.0	14.8	34.7	15.4	34.4	16.0	34.3	16.2	34.1	16.6	33.9	17.2	38
39	35.9	15.2	35.6	15.9	35.3	16.5	35.3	16.7	35.0	17.1	34.7	17.7	39
40	36.8	15.6	36.5	16.3	36.2	16.9	36.2	17.1	35.9	17.5	35.6	18.2	40
41	37.7	16.0	37.5	16.7	37.2	17.3	37.1	17.5	36.8	18.0	36.5	18.6	41
42	38.7	16.4	38.4	17.1	38.1	17.7	38.0	18.0	37.7	18.4	37.4	19.1	42
43	39.6	16.8	39.3	17.5	39.0	18.2	38.9	18.4	38.6	18.8	38.3	19.5	43
44	40.5	17.2	40.2	17.9	39.9	18.6	39.8	18.8	39.5	19.3	39.2	20.0	44
45	41.4	17.6	41.1	18.3	40.8	19.0	40.7	19.2	40.4	19.7	40.1	20.4	45
46	42.3	18.0	42.0	18.7	41.7	19.4	41.6	19.7	41.3	20.2	41.0	20.9	46
47	43.3	18.4	42.9	19.1	42.6	19.9	42.5	20.1	42.2	20.6	41.9	21.3	47
48	44.2	18.8	43.8	19.5	43.5	20.3	43.4	20.5	43.1	21.0	42.8	21.8	48
49	45.1	19.2	44.8	19.9	44.4	20.7	44.3	20.9	44.0	21.5	43.7	22.2	49
50	46.0	19.5	45.7	20.3	45.3	21.1	45.2	21.4	44.9	21.9	44.5	22.7	50
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	67 Deg.		66 Deg.		65 Deg.		5½ Point.		64 Deg.		63 Deg.		

109

Diff.	23 Deg.		24 Deg.		25 Deg.		2½ Point.		26 Deg.		27 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	46.9	19.9	46.6	20.7	46.2	21.5	46.1	21.8	45.8	22.3	45.4	23.2	51
52	47.9	20.3	47.5	21.1	47.1	22.0	47.0	22.2	46.7	22.8	46.3	23.6	52
53	48.8	20.7	48.4	21.5	48.0	22.4	47.9	22.7	47.6	23.2	47.2	24.1	53
54	49.7	21.1	49.3	22.0	48.9	22.8	48.8	23.1	48.5	23.7	48.1	24.5	54
55	50.6	21.5	50.2	22.4	49.8	23.2	49.7	23.5	49.4	24.1	49.0	25.0	55
56	51.5	21.9	51.2	22.8	50.7	23.7	50.6	23.9	50.3	24.5	49.9	25.4	56
57	52.5	22.3	52.1	23.2	51.7	24.1	51.5	24.4	51.2	25.0	50.8	25.9	57
58	53.4	22.7	53.0	23.6	52.6	24.5	52.4	24.8	52.1	25.4	51.7	26.3	58
59	54.3	23.0	53.9	24.0	53.5	24.9	53.3	25.2	53.0	25.9	52.6	26.8	59
60	55.2	23.4	54.8	24.4	54.4	25.4	54.2	25.6	53.9	26.3	53.5	27.2	60
61	56.1	23.8	55.7	24.8	55.3	25.8	55.1	26.1	54.8	26.7	54.4	27.7	61
62	57.1	24.2	56.6	25.2	56.2	26.2	56.0	26.5	55.7	27.2	55.2	28.1	62
63	58.0	24.6	57.5	25.6	57.1	26.6	56.9	26.9	56.6	27.6	56.1	28.6	63
64	58.9	25.0	58.5	26.0	58.0	27.0	57.9	27.4	57.5	28.0	57.0	29.1	64
65	59.8	25.4	59.4	26.4	58.9	27.5	58.8	27.8	58.4	28.5	57.9	29.5	65
66	60.7	25.8	60.3	26.8	59.8	27.9	59.7	28.2	59.3	28.9	58.8	30.0	66
67	61.7	26.2	61.2	27.2	60.7	28.3	60.6	28.6	60.2	29.4	59.7	30.4	67
68	62.6	26.6	62.1	27.7	61.6	28.7	61.5	29.1	61.1	29.8	60.6	30.9	68
69	63.5	27.0	63.0	28.1	62.5	29.2	62.4	29.5	62.0	30.2	61.5	31.3	69
70	64.4	27.3	63.9	28.5	63.4	29.6	63.3	29.9	62.9	30.7	62.4	31.8	70
71	65.4	27.7	64.9	28.9	64.3	30.0	64.2	30.4	63.8	31.1	63.3	32.2	71
72	66.3	28.1	65.8	29.3	65.2	30.4	65.1	30.8	64.7	31.6	64.2	32.7	72
73	67.2	28.5	66.7	29.7	66.2	30.8	66.0	31.2	65.6	32.0	65.0	33.1	73
74	68.1	28.9	67.6	30.1	67.1	31.3	66.9	31.6	66.5	32.4	65.9	33.6	74
75	69.0	29.3	68.5	30.5	68.0	31.7	67.8	32.1	67.4	32.9	66.8	34.1	75
76	70.0	29.7	69.4	30.9	68.9	32.1	68.7	32.5	68.3	33.3	67.7	34.5	76
77	70.9	30.1	70.3	31.3	69.8	32.5	69.6	32.9	69.2	33.7	68.6	35.0	77
78	71.8	30.5	71.2	31.7	70.7	33.0	70.5	33.3	70.1	34.2	69.5	35.4	78
79	72.7	30.9	72.2	32.1	71.6	33.4	71.4	33.8	71.0	34.6	70.4	35.9	79
80	73.6	31.3	73.1	32.5	72.5	33.8	72.3	34.2	71.9	35.1	71.3	36.3	80
81	74.6	31.6	74.0	32.9	73.4	34.2	73.2	34.6	72.8	35.5	72.2	36.8	81
82	75.5	32.0	74.9	33.3	74.3	34.7	74.1	35.1	73.7	35.9	73.1	37.2	82
83	76.4	32.4	75.8	33.8	75.2	35.1	75.0	35.5	74.6	36.4	74.0	37.7	83
84	77.3	32.8	76.7	34.2	76.1	35.5	75.9	35.9	75.5	36.8	74.8	38.1	84
85	78.2	33.2	77.6	34.6	77.0	35.9	76.8	36.3	76.4	37.3	75.7	38.6	85
86	79.2	33.6	78.6	35.0	77.9	36.3	77.7	36.8	77.3	37.7	76.6	39.0	86
87	80.1	34.0	79.5	35.4	78.8	36.8	78.6	37.2	78.2	38.1	77.5	39.5	87
88	81.0	34.4	80.4	35.8	79.7	37.2	79.5	37.6	79.1	38.6	78.4	40.0	88
89	81.9	34.8	81.3	36.2	80.7	37.6	80.5	38.1	80.0	39.0	79.3	40.4	89
90	82.8	35.2	82.2	36.6	81.6	38.0	81.4	38.5	80.9	39.4	80.2	40.9	90
91	83.7	35.6	83.1	37.0	82.5	38.5	82.3	38.9	81.8	39.8	81.1	41.3	91
92	84.7	35.9	84.0	37.4	83.4	38.9	83.2	39.3	82.7	40.3	82.0	41.8	92
93	85.6	36.3	85.0	37.8	84.3	39.3	84.1	39.8	83.6	40.8	82.9	42.2	93
94	86.5	36.7	85.9	38.2	85.2	39.7	85.0	40.2	84.5	41.2	83.8	42.7	94
95	87.4	37.1	86.8	38.6	86.1	40.1	85.9	40.6	85.4	41.6	84.6	43.1	95
96	88.4	37.5	87.7	39.0	87.0	40.6	86.8	41.0	86.3	42.1	85.5	43.6	96
97	89.3	37.9	88.6	39.4	87.9	41.0	87.7	41.5	87.2	42.5	86.4	44.0	97
98	90.2	38.3	89.5	39.9	88.8	41.4	88.6	41.9	88.1	43.0	87.3	44.5	98
99	91.1	38.7	90.4	40.3	89.7	41.8	89.5	42.3	89.0	43.4	88.2	44.9	99
100	92.0	39.1	91.4	40.7	90.6	42.3	90.4	42.7	89.9	43.8	89.1	45.4	100
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	67 Deg.		66 Deg.		65 Deg.		5½ Point.		64 Deg.		63 Deg.		

A Table of Difference

Dif.	28 Deg.		2½ point.		29 Deg.		30 Deg.		2¾ Point.		31 Deg.		Dif.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.9	00.5	00.9	00.5	00.9	00.5	00.9	00.5	00.9	00.5	00.9	00.5	1
2	01.8	00.9	01.8	00.9	01.7	01.0	01.7	01.0	01.7	01.0	01.7	01.0	2
3	02.6	01.4	02.6	01.4	02.6	01.4	02.6	01.4	02.6	01.4	02.6	01.4	3
4	03.5	01.9	03.5	01.9	03.5	01.9	03.5	01.9	03.4	02.1	03.4	02.1	4
5	04.4	02.3	04.4	02.4	04.4	02.4	04.3	02.5	04.3	02.6	04.3	02.6	5
6	05.3	02.8	05.3	02.8	05.2	02.9	05.2	03.0	05.1	03.1	05.1	03.1	6
7	06.2	03.3	06.2	03.3	06.1	03.4	06.1	03.5	06.0	03.6	06.1	03.6	7
8	07.1	03.8	07.1	03.8	07.0	03.9	06.9	04.0	06.9	04.1	06.9	04.1	8
9	07.9	04.2	07.9	04.2	07.9	04.4	07.8	04.5	07.7	04.6	07.7	04.6	9
10	08.8	04.7	08.8	04.7	08.7	04.8	08.7	05.0	08.6	05.1	08.6	05.1	10
11	09.7	05.2	09.7	05.2	09.6	05.3	09.5	05.5	09.4	05.6	09.4	05.7	11
12	10.6	05.6	10.6	05.6	10.5	05.8	10.4	06.0	10.3	06.2	10.3	06.2	12
13	11.5	06.1	11.5	06.1	11.4	06.3	11.3	06.5	11.1	06.7	11.1	06.7	13
14	12.4	06.6	12.4	06.6	12.2	06.8	12.1	07.0	12.0	07.2	12.0	07.2	14
15	13.2	07.0	13.2	07.1	13.1	07.3	13.0	07.5	12.9	07.7	12.9	07.7	15
16	14.1	07.5	14.1	07.5	14.0	07.7	13.9	08.0	13.7	08.2	13.7	08.2	16
17	15.0	08.0	15.0	08.0	14.9	08.2	14.7	08.5	14.6	08.7	14.6	08.8	17
18	15.9	08.4	15.9	08.5	15.7	08.7	15.6	09.0	15.4	09.2	15.4	09.3	18
19	16.8	08.9	16.8	08.9	16.6	09.2	16.4	09.5	16.3	09.8	16.3	09.8	19
20	17.7	09.4	17.6	09.4	17.5	09.7	17.3	10.0	17.1	10.3	17.1	10.3	20
21	18.5	09.9	18.5	09.9	18.4	10.2	18.2	10.5	18.0	10.8	18.0	10.8	21
22	19.4	10.3	19.4	10.3	19.2	10.7	19.0	11.0	18.9	11.3	18.9	11.3	22
23	20.3	10.8	20.3	10.8	20.1	11.1	19.9	11.5	19.7	11.8	19.7	11.8	23
24	21.2	11.3	21.2	11.3	21.0	11.6	20.8	12.0	20.6	12.3	20.6	12.4	24
25	22.1	11.7	22.0	11.8	21.9	12.1	21.6	12.5	21.4	12.8	21.4	12.9	25
26	23.0	12.2	22.9	12.3	22.7	12.6	22.5	13.0	22.3	13.4	22.3	13.4	26
27	23.8	12.7	23.8	12.7	23.6	13.1	23.4	13.5	23.1	13.9	23.1	13.9	27
28	24.7	13.1	24.7	13.2	24.5	13.6	24.2	14.0	24.0	14.4	24.0	14.4	28
29	25.6	13.6	25.6	13.7	25.4	14.1	25.1	14.5	24.9	14.9	24.9	14.9	29
30	26.5	14.1	26.5	14.1	26.2	14.5	26.0	15.0	25.7	15.4	25.7	15.4	30
31	27.4	14.5	27.3	14.6	27.1	15.0	26.8	15.5	26.6	15.9	26.6	16.0	31
32	28.2	15.0	28.2	15.1	28.0	15.5	27.7	16.0	27.4	16.4	27.4	16.5	32
33	29.1	15.5	29.1	15.5	28.9	16.0	28.6	16.5	28.3	17.0	28.3	17.0	33
34	30.0	16.0	30.0	16.0	29.7	16.5	29.5	17.0	29.2	17.5	29.1	17.5	34
35	30.9	16.4	30.9	16.5	30.6	17.0	30.3	17.5	30.0	18.0	30.0	18.0	35
36	31.8	16.9	31.7	17.0	31.5	17.4	31.2	18.0	30.9	18.5	30.9	18.5	36
37	32.7	17.4	32.6	17.4	32.4	17.9	32.0	18.5	31.7	19.0	31.7	19.1	37
38	33.5	17.0	33.5	17.9	33.2	18.4	32.9	19.0	32.5	19.5	32.6	19.6	38
39	34.4	18.3	34.4	18.4	34.1	18.9	33.8	19.5	33.4	20.0	33.4	20.1	39
40	35.3	18.8	35.3	18.9	35.0	19.4	34.6	20.0	34.3	20.6	34.3	20.6	40
41	36.2	19.2	36.1	19.3	35.8	19.9	35.5	20.5	35.2	21.1	35.1	21.1	41
42	37.1	19.7	37.0	19.8	36.7	20.4	36.4	21.0	36.0	21.6	36.0	21.6	42
43	38.0	20.6	37.9	20.3	37.6	20.8	37.2	21.5	36.9	22.1	36.9	22.1	43
44	38.8	20.1	38.8	20.7	38.5	21.3	38.1	22.0	37.7	22.6	37.7	22.6	44
45	39.7	21.1	39.7	21.2	39.3	21.8	39.0	22.5	38.6	23.1	38.6	23.2	45
46	40.6	21.6	40.6	21.7	40.2	22.3	39.8	23.0	39.5	23.6	39.4	23.7	46
47	41.5	22.1	41.4	22.2	41.1	22.8	40.7	23.5	40.3	24.2	40.3	24.2	47
48	42.4	22.5	42.3	22.6	42.0	23.3	41.6	24.0	41.2	24.7	41.1	24.7	48
49	43.3	23.1	43.2	23.2	42.8	23.7	42.4	24.5	42.0	25.2	42.0	25.2	49
50	44.1	23.5	44.1	23.6	43.7	24.2	43.3	25.0	42.9	25.7	42.9	25.7	50
Dif.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dif.
	62 Deg.		5½ Point.		61 Deg.		60 Deg.		5¾ Point.		59 Deg.		

111

Diff.	28 Deg. 2½ Points.				29 Deg.		30 Deg.		2¼ Point.		31 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	45.0	23.9	45.0	24.0	44.6	24.7	44.2	25.5	43.7	26.2	43.7	26.3	51
52	45.9	24.4	45.9	24.5	45.5	25.2	45.0	26.0	44.6	26.7	44.6	26.8	52
53	46.8	24.9	46.7	25.0	46.3	25.7	45.9	26.5	45.5	27.2	45.4	27.3	53
54	47.7	25.3	47.6	25.5	47.2	26.2	46.8	27.0	46.3	27.8	46.3	27.8	54
55	48.6	25.8	48.5	25.9	48.1	26.7	47.6	27.5	47.2	28.3	47.1	28.3	55
56	49.4	26.2	49.4	26.4	49.0	27.1	48.5	28.0	48.0	28.8	48.0	28.8	56
57	50.3	26.8	50.3	26.9	49.8	27.6	49.4	28.5	48.9	29.3	48.9	29.4	57
58	51.2	27.2	51.2	27.3	50.7	28.1	50.2	29.0	49.7	29.8	49.7	29.9	58
59	52.1	27.7	52.0	27.8	51.6	28.6	51.1	29.5	50.6	30.3	50.6	30.4	59
60	53.0	28.2	52.9	28.3	52.5	29.1	52.0	30.0	51.5	30.8	51.4	30.9	60
61	53.9	28.6	53.8	28.7	53.3	29.6	52.8	30.5	52.3	31.4	52.3	31.4	61
62	54.7	29.1	54.7	29.2	54.2	30.1	53.7	31.0	53.2	31.9	53.1	31.9	62
63	55.6	29.6	55.6	29.7	55.1	30.5	54.6	31.5	54.0	32.4	54.0	32.4	63
64	56.5	30.0	56.4	30.2	56.0	31.0	55.4	32.0	54.9	32.9	54.9	33.0	64
65	57.4	30.5	57.3	30.5	56.8	31.5	56.3	32.5	55.7	33.4	55.7	33.5	65
66	58.3	31.0	58.2	31.1	57.7	32.0	57.2	33.0	56.6	33.9	56.6	34.0	66
67	59.2	31.4	59.1	31.6	58.6	32.5	58.0	33.5	57.5	34.4	57.4	34.5	67
68	60.0	31.9	60.0	32.0	59.5	33.0	58.9	34.0	58.3	35.0	58.3	35.0	68
69	60.9	32.4	60.8	32.5	60.3	33.4	59.7	34.5	59.2	35.5	59.1	35.5	69
70	61.8	32.9	61.7	33.0	61.2	33.9	60.6	35.0	60.0	36.0	60.0	36.0	70
71	62.7	33.3	62.6	33.5	62.1	34.4	61.5	35.5	60.9	36.5	60.9	36.6	71
72	63.6	33.8	63.5	33.9	63.0	34.9	62.3	36.0	61.8	37.0	61.7	37.1	72
73	64.4	34.3	64.4	34.4	63.8	35.4	63.2	36.5	62.6	37.5	62.6	37.6	73
74	65.3	34.7	65.3	34.9	64.7	35.9	64.1	37.0	63.5	38.0	63.4	38.1	74
75	66.2	35.2	66.1	35.4	65.6	36.4	64.9	37.5	64.3	38.6	64.3	38.6	75
76	67.1	35.7	67.0	35.8	66.5	36.8	65.8	38.0	65.2	39.1	65.1	39.1	76
77	68.0	36.1	67.9	36.3	67.3	37.3	66.7	38.5	66.0	39.6	66.0	39.7	77
78	68.9	36.6	68.8	36.8	68.2	37.8	67.5	39.0	66.9	40.1	66.9	40.2	78
79	69.7	37.1	69.7	37.2	69.1	38.3	68.4	39.5	67.8	40.6	67.7	40.7	79
80	70.6	37.6	70.5	37.7	70.0	38.8	69.3	40.0	68.6	41.1	68.6	41.2	80
81	71.5	38.0	71.4	38.2	70.8	39.3	70.1	40.5	69.3	41.6	69.4	41.7	81
82	72.4	38.5	72.3	38.6	71.7	39.7	70.9	41.0	70.3	42.2	70.3	42.2	82
83	73.3	39.0	73.2	39.1	72.6	40.2	71.9	41.5	71.2	42.7	71.1	42.7	83
84	74.2	39.4	74.1	39.6	73.5	40.7	72.7	42.0	72.1	43.2	72.0	43.3	84
85	75.0	39.9	75.0	40.1	74.3	41.2	73.6	42.5	72.9	43.7	72.9	43.8	85
86	75.9	40.4	75.8	40.5	75.2	41.7	74.5	43.0	73.8	44.2	73.7	44.3	86
87	76.8	40.8	76.7	41.0	76.1	42.2	75.3	43.5	74.6	44.7	74.6	44.8	87
88	77.7	41.3	77.6	41.5	77.0	42.7	76.2	44.0	75.5	45.2	75.4	45.3	88
89	78.6	41.8	78.5	41.9	77.8	43.1	77.1	44.5	76.3	45.8	76.3	45.8	89
90	79.5	42.2	79.4	42.4	78.7	43.6	77.9	45.0	77.2	46.3	77.1	46.3	90
91	80.3	42.7	80.2	42.9	79.6	44.1	78.8	45.5	78.1	46.8	78.0	46.9	91
92	81.2	43.2	81.1	43.4	80.5	44.6	79.7	46.0	78.9	47.3	78.9	47.4	92
93	82.1	43.6	82.0	43.8	81.3	45.1	80.5	46.5	79.8	47.8	79.7	47.9	93
94	83.0	44.1	82.9	44.3	82.2	45.6	81.4	47.0	80.6	48.3	80.6	48.4	94
95	83.9	44.6	83.8	44.8	83.1	46.1	82.3	47.5	81.5	48.8	81.4	48.9	95
96	84.8	45.1	84.7	45.2	84.0	46.5	83.1	48.0	82.3	49.3	82.3	49.4	96
97	85.6	45.5	85.5	45.7	84.8	47.0	84.0	48.5	83.2	49.9	83.1	50.0	97
98	86.5	46.0	86.4	46.2	85.7	47.5	84.9	49.0	84.1	50.4	84.0	50.5	98
99	87.4	46.5	87.3	46.7	86.6	48.0	85.7	49.5	84.9	50.9	84.9	51.0	99
100	88.3	46.9	88.2	47.1	87.5	48.5	86.6	50.0	85.8	51.4	85.7	51.5	100
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
62 Deg.	5½ Points.				61 Deg.	60 Deg.	5¼ Point.	59 Deg.	100				Diff.

Diff.	32 Deg.		33 Deg.		3 Points.		34 Deg.		35 Deg.		36 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.8	00.5	00.8	00.5	00.8	00.6	00.8	00.6	00.8	00.6	00.8	00.6	1
2	01.7	01.1	01.7	01.1	01.7	01.1	01.7	01.1	01.6	01.1	01.6	01.2	2
3	02.4	01.6	02.5	01.6	02.5	01.7	02.5	01.7	02.5	01.7	02.4	01.8	3
4	03.3	02.1	03.4	02.2	03.3	02.2	03.3	02.2	03.3	02.3	03.2	02.3	4
5	04.2	02.6	04.2	02.7	04.2	02.8	04.1	02.8	04.1	02.9	04.0	02.9	5
6	05.1	03.2	05.0	03.3	05.0	03.3	05.0	03.4	04.9	03.4	04.8	03.5	6
7	05.9	03.7	05.9	03.8	05.8	03.9	05.8	03.9	05.7	04.0	05.7	04.1	7
8	06.8	04.2	06.7	04.4	06.6	04.4	06.6	04.5	06.5	04.6	06.5	04.7	8
9	07.6	04.8	07.5	04.9	07.5	05.0	07.5	05.0	07.4	05.2	07.3	05.3	9
10	08.5	05.3	08.4	05.4	08.3	05.6	08.3	05.6	08.2	05.7	08.1	05.9	10
11	09.3	05.8	09.2	06.0	09.1	06.1	09.1	06.1	09.0	06.3	08.9	06.5	11
12	10.2	06.4	10.1	06.5	10.0	06.7	09.9	06.7	09.8	06.9	09.7	07.0	12
13	11.0	06.9	10.9	07.1	10.8	07.2	10.8	07.3	10.6	07.5	10.5	07.6	13
14	11.9	07.4	11.7	07.6	11.6	07.8	11.6	07.8	11.5	08.0	11.3	08.2	14
15	12.7	07.9	12.6	08.2	12.5	08.3	12.4	08.4	12.3	08.6	12.1	08.8	15
16	13.6	08.5	13.4	08.7	13.3	08.9	13.3	08.9	13.1	09.2	12.9	09.4	16
17	14.4	09.0	14.3	09.3	14.1	09.4	14.1	09.5	13.9	09.8	13.7	10.0	17
18	15.3	09.5	15.1	09.8	15.0	10.0	15.9	10.1	14.7	10.3	14.6	10.6	18
19	16.1	10.1	15.9	10.3	15.8	10.6	15.7	10.6	15.6	10.9	15.4	11.2	19
20	17.0	10.5	16.8	10.9	16.6	11.1	16.6	11.2	16.4	11.5	16.2	11.8	20
21	17.8	11.1	17.6	11.4	17.5	11.7	17.4	11.7	17.2	12.0	17.0	12.3	21
22	18.6	11.7	18.5	12.0	18.3	12.2	18.2	12.3	18.0	12.6	17.8	12.9	22
23	19.5	12.2	19.3	12.5	19.1	12.8	19.0	12.8	18.8	13.2	18.6	13.5	23
24	20.3	12.7	20.1	13.1	20.0	13.3	19.9	13.4	19.7	13.8	19.4	14.1	24
25	21.2	13.2	21.0	13.6	20.7	13.9	20.7	14.0	20.5	14.3	20.1	14.7	25
26	22.0	13.8	21.8	14.2	21.6	14.4	21.5	14.5	21.3	14.9	21.0	15.3	26
27	22.9	14.3	22.6	14.7	22.4	15.0	22.4	15.1	22.1	15.5	21.8	15.9	27
28	23.7	14.8	23.5	15.2	23.3	15.5	23.2	15.6	22.9	16.1	22.6	16.5	28
29	24.6	15.4	24.3	15.8	24.1	16.1	24.0	16.2	23.8	16.6	23.5	17.0	29
30	25.4	15.9	25.2	16.3	24.9	16.7	24.9	16.8	24.6	17.2	24.3	17.6	30
31	26.3	16.4	26.0	16.9	25.8	17.2	25.7	17.3	25.4	17.8	25.1	18.2	31

of Latitude and Departure.

113

Diff.	32 Deg.		33 Deg.		3 Point.		34 Deg.		35 Deg.		36 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	43.2	27.0	42.8	27.8	42.4	28.3	42.3	28.5	41.8	29.2	41.3	30.0	51
52	44.1	27.6	43.6	28.3	43.2	28.9	43.1	29.1	42.6	29.8	42.1	30.6	52
53	44.9	28.1	44.5	28.9	44.1	29.4	43.9	29.6	43.4	30.4	42.9	31.2	53
54	45.8	28.6	45.3	29.4	44.9	30.0	44.5	30.2	44.2	31.0	43.7	31.7	54
55	46.6	29.1	46.1	30.0	45.7	30.6	45.6	30.7	45.1	31.5	44.5	32.3	55
56	47.5	29.7	47.0	30.5	46.6	31.1	46.4	31.3	45.9	32.1	45.3	32.9	56
57	48.3	30.2	47.8	31.0	47.4	31.7	47.3	31.9	46.7	32.7	46.1	33.5	57
58	49.2	30.7	48.7	31.6	48.2	32.2	48.1	32.4	47.5	33.3	46.9	34.1	58
59	50.0	31.3	49.5	32.1	48.0	32.8	48.9	33.0	48.3	33.8	47.7	34.7	59
60	50.9	31.8	50.3	32.7	49.9	33.3	49.7	33.5	49.1	34.4	48.5	35.3	60
61	51.7	32.3	51.2	33.2	50.7	33.9	50.6	34.1	50.0	34.9	49.3	35.9	61
62	52.6	32.9	52.0	33.8	51.5	34.4	51.4	34.7	50.8	35.6	50.2	36.4	62
63	53.4	33.4	52.9	34.3	52.4	35.0	52.2	35.2	51.6	36.1	51.0	37.0	63
64	54.3	33.9	53.7	34.9	53.2	35.5	53.1	35.8	52.4	36.7	51.8	37.6	64
65	55.1	34.4	54.5	35.4	54.0	36.1	53.9	36.3	53.2	37.3	52.6	38.2	65
66	56.0	35.0	55.3	35.9	54.9	36.7	54.7	36.9	54.1	37.9	53.4	38.8	66
67	56.8	35.5	56.2	36.5	55.7	37.2	55.5	37.5	54.9	38.4	54.2	39.4	67
68	57.7	36.0	57.0	37.0	56.5	37.8	56.4	38.0	55.7	39.0	55.0	40.0	68
69	58.5	36.6	57.9	37.6	57.4	38.3	57.2	38.6	56.5	39.6	55.8	40.6	69
70	59.4	37.1	58.7	38.1	58.2	38.9	58.0	39.1	57.3	40.1	56.6	41.1	70
71	60.2	37.6	59.6	38.7	59.0	39.4	58.9	39.7	58.2	40.7	57.4	41.7	71
72	61.0	38.1	60.4	39.2	59.8	40.0	59.7	40.3	59.0	41.3	58.2	42.3	72
73	61.9	38.7	61.2	39.8	60.7	40.6	60.5	40.8	59.8	41.9	59.1	42.9	73
74	62.7	39.2	62.1	40.3	61.5	41.1	61.3	41.4	60.6	42.4	59.9	43.5	74
75	63.6	39.7	62.9	40.8	62.4	41.7	62.2	41.9	61.4	43.0	60.7	44.1	75
76	64.4	40.3	63.8	41.5	63.2	42.2	63.0	42.5	62.3	43.6	61.5	44.7	76
77	65.3	40.8	64.6	41.9	64.0	42.8	63.8	43.0	63.1	44.2	62.3	45.3	77
78	66.1	41.3	65.4	42.5	64.8	43.3	64.7	43.6	63.9	44.7	63.1	45.8	78
79	67.0	41.9	66.3	43.0	65.7	43.9	65.5	44.2	64.7	45.3	63.9	46.4	79
80	67.8	42.4	67.1	43.6	66.5	44.4	66.3	44.7	65.5	45.9	64.7	47.0	80
81	68.7	42.9	68.0	44.1	67.3	45.0	67.1	45.3	66.4	46.5	65.5	47.6	81
82	69.5	43.4	68.8	44.7	68.2	45.5	68.0	45.8	67.2	47.0	66.3	48.2	82
83	70.4	44.0	69.6	45.2	69.0	46.1	68.8	46.4	68.0	47.6	67.1	48.8	83
84	71.2	44.5	70.5	45.8	69.8	46.7	69.6	47.0	68.8	48.2	68.0	49.4	84
85	72.1	45.0	71.3	46.3	70.7	47.2	70.5	47.5	69.6	48.8	68.8	50.0	85
86	72.9	45.6	72.1	46.8	71.5	47.8	71.3	48.1	70.5	49.3	69.6	50.5	86
87	73.8	46.1	73.0	47.3	72.3	48.3	72.1	48.6	71.3	49.9	70.4	51.1	87
88	74.6	46.6	73.8	47.9	73.2	48.9	72.9	49.2	72.1	50.5	71.2	51.7	88
89	75.5	47.2	74.7	48.5	74.0	49.4	73.8	49.8	72.9	51.0	72.0	52.3	89
90	76.3	47.7	75.5	49.0	74.8	50.0	74.6	50.3	73.7	51.6	72.8	52.9	90
91	77.2	48.2	76.3	49.6	75.7	50.6	75.4	50.9	74.5	52.2	73.6	53.5	91
92	78.0	48.7	77.2	50.1	76.5	51.1	76.3	51.4	75.4	52.8	74.4	54.1	92
93	78.9	49.3	78.0	50.6	77.3	51.7	77.1	52.0	76.2	53.3	75.2	54.7	93
94	79.7	49.8	78.9	51.2	78.2	52.2	77.9	52.6	77.0	53.9	76.0	55.2	94
95	80.6	50.3	79.7	51.7	79.0	52.8	78.8	53.1	77.8	54.5	76.9	55.8	95
96	81.4	50.9	80.5	52.3	79.8	53.3	79.6	53.7	78.6	55.1	77.7	56.4	96
97	82.3	51.4	81.4	52.8	80.6	53.9	80.4	54.2	79.5	55.6	78.5	57.0	97
98	83.1	51.9	82.2	53.4	81.5	54.4	81.2	54.8	80.3	56.2	79.3	57.6	98
99	84.0	52.5	83.1	53.9	82.3	55.0	82.1	55.4	81.1	56.8	80.1	58.2	99
100	84.8	53.0	83.9	54.5	83.1	55.6	82.9	55.9	81.9	57.4	80.9	58.8	100
Diff.	58 Deg.		57 Deg.		5 Point.		56 Deg.		55 Deg.		54 Deg.		Diff.
	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	

A Table of Difference

Diff.	3 1/4 Point.		37 Deg.		38 Deg.		39 Deg.		3 1/2 Point.		40 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.8	00.6	00.8	00.6	00.8	00.6	00.8	00.7	00.8	00.6	00.8	00.6	1
2	01.6	01.2	01.6	01.2	01.6	01.2	01.5	01.3	01.5	01.3	01.5	01.3	2
3	02.4	01.8	02.4	01.8	02.4	01.8	02.3	01.9	02.3	01.9	02.3	01.9	3
4	03.2	02.4	03.2	02.4	03.1	02.5	03.5	02.5	03.1	02.5	03.1	02.6	4
5	04.0	03.0	04.0	03.0	03.9	03.1	03.9	03.1	03.9	03.2	03.8	03.2	5
6	04.8	03.6	04.8	03.6	04.7	03.7	04.6	03.9	04.6	03.8	04.6	03.9	6
7	05.6	04.2	05.6	04.2	05.5	04.3	05.4	04.4	05.4	04.4	05.4	04.5	7
8	06.4	04.8	06.4	04.8	06.3	04.9	06.2	05.0	06.2	05.1	06.1	05.1	8
9	07.2	05.4	07.2	05.4	07.1	05.5	07.0	05.7	07.0	05.7	06.9	05.8	9
10	08.0	06.0	08.0	06.0	07.9	06.2	07.8	06.3	07.7	06.3	07.7	06.4	10
11	08.8	06.6	08.8	06.6	08.7	06.8	08.5	06.9	08.5	07.0	08.4	07.1	11
12	09.6	07.1	09.6	07.2	09.4	07.4	09.3	07.5	09.3	07.6	09.2	07.7	12
13	10.4	07.7	10.4	07.8	10.2	08.1	10.1	08.2	10.0	08.2	10.0	08.4	13
14	11.2	08.3	11.2	08.4	11.0	08.7	10.9	08.8	10.8	08.9	10.7	09.0	14
15	12.0	08.9	12.0	09.0	11.8	09.3	11.6	09.4	11.6	09.5	11.5	09.6	15
16	12.8	09.5	12.8	09.6	12.6	09.8	12.4	10.1	12.4	10.1	12.3	10.3	16
17	13.6	10.1	13.6	10.2	13.4	10.5	13.2	10.7	13.1	10.8	13.0	10.9	17
18	14.5	10.7	14.4	10.8	14.2	11.1	13.9	11.3	13.9	11.4	13.8	11.6	18
19	15.3	11.3	15.2	11.4	15.0	11.7	14.8	12.0	14.7	12.0	14.5	12.2	19
20	16.1	11.9	16.0	12.0	15.8	12.3	15.5	12.6	15.5	12.7	15.3	12.9	20
21	16.9	12.5	16.8	12.6	16.5	12.9	16.3	13.2	16.2	13.3	16.1	13.5	21
22	17.7	13.1	17.6	13.2	17.3	13.5	17.1	13.8	17.0	14.0	16.8	14.1	22
23	18.5	13.7	18.4	13.8	18.1	14.2	17.9	14.5	17.8	14.6	17.6	14.8	23
24	19.3	14.3	19.2	14.4	18.9	14.8	18.6	15.1	18.5	15.2	18.4	15.4	24
25	20.1	14.9	20.0	15.0	19.7	15.4	19.4	15.7	19.3	15.9	19.1	16.1	25
26	20.9	15.5	20.8	15.6	20.5	16.0	20.2	16.4	20.1	16.5	19.9	16.7	26
27	21.7	16.1	21.6	16.2	21.3	16.6	21.0	17.0	20.9	17.1	20.7	17.4	27
28	22.5	16.7	22.4	16.8	22.1	17.2	21.8	17.6	21.6	17.8	21.4	18.0	28
29	23.3	17.3	23.2	17.4	22.8	17.8	22.1	18.3	22.4	18.4	22.2	18.6	29
30	24.1	17.9	24.0	18.0	23.6	18.5	23.3	18.9	23.2	19.0	23.0	19.3	30
31	24.9	18.5	24.8	18.6	24.4	19.1	24.1	19.5	24.0	19.7	23.7	19.9	31
32	25.7	19.1	25.6	19.3	25.2	19.7	24.9	20.1	24.7	20.3	24.5	20.6	32
33	26.5	19.7	26.4	19.9	26.0	20.3	25.6	20.8	25.5	20.9	25.3	21.2	33
34	27.3	20.2	27.1	20.5	26.8	20.9	26.4	21.4	26.3	21.6	26.0	21.9	34
35	28.1	20.8	27.9	21.1	27.6	21.5	27.2	22.0	27.0	22.2	26.8	22.5	35
36	28.9	21.4	28.7	21.7	28.4	22.2	27.7	22.7	27.8	22.8	27.6	23.1	36
37	29.7	22.0	29.5	22.3	29.2	22.8	28.8	23.3	28.6	23.5	28.3	23.8	37
38	30.5	22.6	30.3	22.9	29.9	23.4	29.5	23.9	29.4	24.1	29.1	24.4	38
39	31.3	23.2	31.1	23.5	30.7	24.0	30.3	24.5	30.1	24.7	29.9	25.1	39
40	32.1	23.8	31.9	24.1	31.5	24.6	31.1	25.2	30.9	25.4	30.6	25.7	40
41	32.9	24.4	32.7	24.7	32.3	25.2	31.9	25.8	31.7	26.0	31.4	26.4	41
42	33.7	25.0	33.5	25.3	33.1	25.9	32.6	26.4	32.5	26.6	32.2	27.0	42
43	34.5	25.6	34.3	25.9	33.9	26.5	33.4	27.1	33.2	27.3	32.9	27.6	43
44	35.3	26.2	35.1	26.5	34.7	27.1	34.2	27.7	34.0	27.9	33.7	28.3	44
45	36.1	26.8	35.9	27.1	35.5	27.7	35.0	28.3	34.8	28.5	34.5	28.9	45
46	36.9	27.4	36.7	27.7	36.2	28.3	35.7	29.0	35.6	29.2	35.2	29.6	46
47	37.7	28.0	37.5	28.3	37.0	28.9	36.5	29.6	36.3	29.8	36.0	30.2	47
48	38.5	28.6	38.3	28.9	37.8	29.5	37.8	30.2	37.1	30.4	36.8	30.9	48
49	39.3	29.2	39.1	29.5	38.6	30.2	38.1	30.8	37.9	31.1	37.5	31.5	49
50	40.2	29.8	39.9	30.1	39.4	30.8	38.9	31.5	38.6	31.7	38.3	32.1	50
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	4 1/4 Point.		53 Deg.		52 Deg.		51 Deg.		4 1/2 Point.		50 Deg.		

of Latitude and Departure.

115

Diff.	3 $\frac{1}{4}$ Point.		37 Deg.		38 Deg.		39 Deg.		3 $\frac{1}{4}$ Point.		40 Deg.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	41.0	30.4	40.7	30.7	40.2	31.4	39.6	32.1	39.4	32.3	39.1	32.8	51
52	41.8	31.0	41.5	31.3	41.0	32.0	40.4	32.7	40.2	33.0	39.8	33.4	52
53	42.6	31.6	42.3	31.9	41.8	32.6	41.2	33.3	41.0	33.6	40.6	34.1	53
54	43.4	32.2	43.1	32.5	42.5	33.2	42.0	34.0	41.7	34.3	41.4	34.7	54
55	44.2	32.8	43.9	33.1	43.3	33.9	42.7	34.6	42.5	34.9	42.1	35.4	55
56	45.0	33.3	44.7	33.8	44.1	34.5	43.5	35.2	43.3	35.5	42.9	36.0	56
57	45.8	33.9	45.5	34.3	44.9	35.1	44.3	35.9	44.1	36.2	43.7	36.6	57
58	46.6	34.5	46.3	34.9	45.7	35.8	45.1	36.5	44.8	36.8	44.4	37.3	58
59	47.4	35.1	47.1	35.5	46.5	36.3	45.8	37.1	45.6	37.4	45.2	37.9	59
60	48.2	35.7	47.9	36.1	47.3	36.9	46.6	37.8	46.4	38.1	46.0	38.6	60
61	49.0	36.3	48.7	36.7	48.1	37.5	47.4	38.4	47.1	38.7	46.7	39.2	61
62	49.8	36.9	49.5	37.3	48.9	38.2	48.2	39.0	47.9	39.3	47.5	39.9	62
63	50.6	37.5	50.3	37.9	49.6	38.8	49.0	39.6	48.7	40.0	48.3	40.5	63
64	51.4	38.1	51.1	38.5	50.4	39.4	49.7	40.3	49.5	40.6	49.0	41.2	64
65	52.2	38.7	51.9	39.1	51.2	40.0	50.5	40.9	50.2	41.2	49.8	41.8	65
66	53.0	39.3	52.7	39.7	52.0	40.6	51.3	41.5	51.0	41.9	50.5	42.4	66
67	53.8	39.9	53.5	40.3	52.8	41.2	52.1	42.2	51.8	42.5	51.3	43.1	67
68	54.6	40.5	54.3	40.9	53.6	41.9	52.8	42.8	52.6	43.1	52.1	43.7	68
69	55.4	41.1	55.1	41.5	54.4	42.5	53.6	43.4	53.3	43.8	52.9	44.4	69
70	56.2	41.7	55.9	42.1	55.2	43.1	54.4	44.0	54.1	44.4	53.6	45.0	70
71	57.0	42.3	56.7	42.7	55.9	43.7	55.2	44.7	54.9	45.0	54.4	45.6	71
72	57.8	42.9	57.5	43.3	56.7	44.3	55.9	45.3	55.7	45.7	55.1	46.3	72
73	58.6	43.5	58.3	43.9	57.5	44.9	56.7	45.9	56.4	46.3	55.9	46.9	73
74	59.4	44.1	59.1	44.5	58.3	45.6	57.5	46.6	57.2	46.9	56.7	47.6	74
75	60.2	44.7	59.9	45.1	59.2	46.2	58.3	47.2	58.0	47.6	57.4	48.2	75
76	61.0	45.3	60.7	45.7	60.0	46.8	59.1	47.8	58.7	48.2	58.2	48.9	76
77	61.8	45.9	61.5	46.3	60.7	47.4	59.8	48.5	59.5	48.8	59.0	49.5	77
78	62.7	46.5	62.3	46.9	61.5	48.0	60.6	49.1	60.3	49.5	59.7	50.1	78
79	63.5	47.1	63.1	47.5	62.2	48.6	61.4	49.7	61.1	50.1	60.5	50.8	79
80	64.3	47.7	63.9	48.1	63.0	49.3	62.2	50.3	61.8	50.7	61.3	51.4	80
81	65.1	48.3	64.7	48.7	63.8	49.9	62.9	51.0	62.6	51.4	62.0	52.1	81
82	65.9	48.8	65.5	49.3	64.6	50.5	63.7	51.6	63.4	52.0	62.8	52.7	82
83	66.7	49.4	66.3	49.9	65.4	51.1	64.5	52.2	64.2	52.6	63.6	53.4	83
84	67.5	50.0	67.1	50.5	66.2	51.7	65.3	52.9	64.9	53.3	64.3	54.0	84
85	68.3	50.6	67.9	51.1	67.0	52.3	66.1	53.5	65.7	53.9	65.1	54.6	85
86	69.1	51.2	68.7	51.7	67.8	52.9	66.8	54.1	66.5	54.6	65.9	55.3	86
87	69.9	51.8	69.5	52.4	68.6	53.6	67.6	54.8	67.2	55.2	66.6	55.9	87
88	70.7	52.4	70.2	53.0	69.3	54.2	68.4	55.4	68.0	55.8	67.4	56.6	88
89	71.5	53.0	71.1	53.6	70.1	54.8	69.2	56.0	68.8	56.5	68.2	57.2	89
90	72.3	53.6	71.9	54.2	70.9	55.4	69.9	56.6	69.6	57.1	68.9	57.4	90
91	73.1	54.2	72.7	54.8	71.7	56.0	70.7	57.3	70.3	57.7	69.7	58.5	91
92	73.9	54.8	73.5	55.4	72.5	56.6	71.5	57.9	71.1	58.4	70.5	59.1	92
93	74.7	55.4	74.3	56.0	73.3	57.3	72.3	58.5	71.9	59.0	71.2	59.8	93
94	75.5	56.0	75.1	56.6	74.1	57.9	73.0	59.2	72.7	59.6	72.0	60.4	94
95	76.3	56.6	75.9	57.2	74.9	58.5	73.8	59.8	73.4	60.3	72.8	61.1	95
96	77.1	57.2	76.7	57.8	75.6	59.1	74.6	60.4	74.2	60.9	73.5	61.7	96
97	77.9	57.8	77.5	58.4	76.4	59.7	75.4	61.0	75.0	61.5	74.3	62.1	97
98	78.7	58.4	78.3	59.0	77.2	60.3	76.2	61.7	75.7	62.2	75.2	63.0	98
99	79.5	59.0	79.1	59.6	78.0	60.9	76.9	62.3	76.5	62.8	75.8	63.6	99
100	80.3	59.6	79.9	60.2	78.8	61.6	77.7	62.9	77.3	63.4	76.6	64.3	100
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	4 $\frac{1}{4}$ Point.	53 Deg.		52 Deg.		51 Deg.		4 $\frac{1}{4}$ Point.		50 Deg.			

Diff.	41 Deg.		42 Deg.		3 $\frac{1}{4}$ Point.		43 Deg.		44 Deg.		4 Point.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.7	00.7	00.7	00.7	00.7	00.7	00.7	00.7	00.7	00.7	00.7	00.7	1
2	01.5	01.3	01.5	01.3	01.5	01.3	01.5	01.4	01.4	01.4	01.4	01.4	2
3	02.3	02.0	02.2	02.0	02.2	02.0	02.2	02.0	02.1	02.1	02.1	02.1	3
4	03.0	02.6	03.0	02.7	03.0	02.7	02.9	02.7	02.9	02.8	02.8	02.8	4
5	03.8	03.3	03.7	03.3	03.7	03.4	03.6	03.4	03.6	03.5	03.5	03.5	5
6	04.5	03.9	04.5	04.0	04.4	04.0	04.4	04.1	04.3	04.2	04.2	04.2	6
7	05.3	04.6	05.2	04.7	05.2	04.7	05.1	04.8	05.0	04.9	04.9	04.9	7
8	06.0	05.2	05.9	05.3	05.9	05.4	05.8	05.5	05.7	05.6	05.7	05.7	8
9	06.8	05.9	06.7	06.0	06.7	06.0	06.6	06.1	06.5	06.2	06.4	06.4	9
10	07.5	06.6	07.4	06.7	07.4	06.7	07.3	06.8	07.2	06.9	07.1	07.1	10
11	08.3	07.2	08.2	07.4	08.1	07.4	08.0	07.5	07.9	07.6	07.8	07.8	11
12	09.1	07.9	08.9	08.0	08.9	08.1	08.8	08.2	08.6	08.3	08.5	08.5	12
13	09.8	08.5	09.7	08.7	09.6	08.7	09.5	08.9	09.3	09.0	09.2	09.2	13
14	10.6	09.2	10.4	09.4	10.4	09.4	10.2	09.5	10.1	09.7	09.9	09.9	14
15	11.3	09.8	11.1	10.0	11.1	10.1	11.0	10.2	10.8	10.4	10.6	10.6	15
16	12.1	10.5	11.9	10.7	11.9	10.7	11.7	10.9	11.5	11.1	11.3	11.3	16
17	12.8	11.1	12.6	11.4	12.6	11.4	12.4	11.6	12.2	11.8	12.0	12.0	17
18	13.6	11.8	13.4	12.0	13.3	12.1	13.2	12.3	12.9	12.5	12.7	12.7	18
19	14.3	12.5	14.1	12.7	14.1	12.8	13.9	13.0	13.7	13.2	13.4	13.4	19
20	15.1	13.1	14.9	13.4	14.8	13.4	14.6	13.6	14.4	13.9	14.1	14.1	20
21	15.8	13.8	15.6	14.0	15.6	14.1	15.4	14.3	15.1	14.6	14.8	14.8	21
22	16.6	14.4	16.3	14.7	16.3	14.8	16.1	15.0	15.8	15.3	15.5	15.5	22
23	17.4	15.1	17.1	15.4	17.0	15.4	16.8	15.7	16.5	16.0	16.3	16.3	23
24	18.1	15.7	17.8	16.1	17.8	16.1	17.5	16.4	17.3	16.7	17.0	17.0	24
25	18.9	16.4	18.6	16.7	18.5	16.8	18.3	17.1	18.0	17.4	17.7	17.7	25
26	19.6	17.1	19.3	17.5	19.3	17.4	19.0	17.7	18.7	18.1	18.4	18.4	26
27	20.4	17.7	20.1	18.1	20.0	18.1	19.7	18.4	19.4	18.8	19.1	19.1	27
28	21.1	18.4	20.8	18.7	20.7	18.8	20.5	19.1	20.2	19.4	19.8	19.8	28
29	21.9	19.0	21.5	19.4	21.5	19.5	21.2	19.1	20.9	20.8	20.5	20.5	29
30	22.6	19.7	22.3	20.1	22.2	20.1	21.9	20.5	21.6	20.8	21.2	21.2	30
31	23.4	20.3	23.0	20.7	23.0	20.8	22.6	21.1	22.3	21.5	21.9	21.9	31
32	24.1	21.0	23.8	21.4	23.7	21.5	23.4	21.8	23.0	22.2	22.6	22.6	32
33	24.9	21.6	24.5	22.1	24.4	22.2	24.1	22.5	23.7	22.9	23.3	23.3	33
34	25.6	22.3	25.3	22.7	25.2	22.8	24.9	23.2	24.5	23.6	24.0	24.0	34
35	26.4	23.0	26.0	23.4	25.9	23.5	25.6	23.9	25.2	24.3	24.7	24.7	35
36	27.2	23.6	26.7	24.1	26.7	24.2	26.3	24.5	25.9	25.0	25.4	25.4	36
37	27.9	24.3	27.5	24.7	27.4	24.8	27.0	25.2	25.6	25.7	26.1	26.1	37
38	28.7	24.9	28.2	25.4	28.2	25.5	27.8	25.9	27.3	26.4	26.9	26.9	38
39	29.4	25.6	29.0	26.1	28.9	26.2	28.5	26.6	28.0	27.1	27.6	27.6	39
40	30.2	26.2	29.7	26.8	29.6	26.9	29.2	27.3	28.8	27.8	28.3	28.3	40
41	31.0	26.9	30.5	27.4	30.4	27.5	30.0	28.0	29.5	28.5	29.0	29.0	41
42	31.7	27.5	31.2	28.1	31.1	28.2	30.7	28.6	30.2	29.2	29.7	29.7	42
43	32.5	28.2	31.9	28.8	31.9	28.9	31.4	29.3	30.9	29.9	30.4	30.4	43
44	33.2	28.9	32.7	29.4	32.6	29.5	32.2	30.0	31.6	30.6	31.1	31.1	44
45	34.0	29.5	33.4	30.1	33.3	30.2	32.9	30.7	32.4	31.3	31.8	31.8	45
46	34.7	30.2	34.2	30.8	34.1	30.9	33.6	31.4	33.1	32.0	32.5	32.5	46
47	35.5	30.8	34.9	31.4	34.8	31.6	34.4	32.1	33.8	32.6	33.2	33.2	47
48	36.3	31.5	35.7	32.1	35.6	32.2	35.1	32.7	34.5	33.3	33.9	33.9	48
49	37.0	32.1	36.4	32.8	36.3	32.9	35.8	33.4	35.2	34.0	34.6	34.6	49
50	37.7	32.8	37.2	33.5	37.0	33.6	36.6	34.1	36.0	34.7	35.3	35.3	50
Diff.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Diff.
	49 Deg.		48 Deg.		4 $\frac{1}{4}$ Point.		47 Deg.		46 Deg.		4 Point.		

of Latitude and Departure.

117

Diff.	41 Deg.		42 Deg.		3 $\frac{1}{4}$ Point.		43 Deg.		44 Deg.		4 Point.		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	38.5	33.5	37.9	34.1	37.8	34.2	37.3	34.8	36.7	35.4	36.1	36.1	51
52	39.2	34.1	38.6	34.8	38.5	34.9	38.0	35.5	37.4	36.1	36.8	36.8	52
53	40.0	34.8	39.4	35.5	39.3	35.6	38.8	36.1	38.1	36.8	37.5	37.5	53
54	40.8	35.4	40.1	36.1	40.0	36.3	39.5	36.6	38.8	37.5	38.2	38.2	54
55	41.5	36.0	40.9	36.8	40.7	36.9	40.2	37.5	39.6	38.2	38.9	38.9	55
56	42.3	36.7	41.6	37.5	41.5	37.6	41.0	38.2	40.3	38.9	39.6	39.6	56
57	43.0	37.4	42.4	38.1	42.2	38.3	41.7	38.9	41.0	39.6	40.3	40.3	57
58	43.8	38.1	43.1	38.8	43.0	38.9	42.4	39.5	41.7	40.3	41.0	41.0	58
59	44.5	38.7	43.8	39.5	43.7	39.6	43.1	40.2	42.4	41.0	41.7	41.7	59
60	45.3	39.4	44.6	40.1	44.5	40.3	43.8	40.9	43.2	41.7	42.4	42.4	60
61	46.0	40.0	45.3	40.8	45.2	41.0	44.6	41.7	43.9	42.4	43.1	43.1	61
62	46.8	40.7	46.1	41.5	45.9	41.6	45.3	42.3	44.6	43.1	43.8	43.8	62
63	47.6	41.3	46.8	42.2	46.7	42.3	46.1	43.0	45.3	43.8	44.5	44.5	63
64	48.3	42.0	47.5	42.8	47.4	43.0	46.8	43.6	46.0	44.5	45.3	45.3	64
65	49.1	42.6	48.3	43.5	48.2	43.6	47.5	44.3	46.8	45.1	46.0	46.0	65
66	49.8	43.3	49.0	44.2	48.9	44.3	48.3	45.0	47.5	45.8	46.7	46.7	66
67	50.6	44.0	49.8	44.8	49.6	45.0	49.0	45.7	48.2	46.5	47.4	47.4	67
68	51.3	44.6	50.5	45.5	50.4	45.7	49.7	46.4	48.9	47.2	48.1	48.1	68
69	52.1	45.3	51.3	46.2	51.1	46.3	50.5	47.1	49.6	47.9	48.8	48.8	69
70	52.8	45.9	52.0	46.8	51.9	47.0	51.2	47.7	50.3	48.6	49.5	49.5	70
71	53.6	46.6	52.8	47.5	52.6	47.7	51.9	48.4	51.1	49.3	50.2	50.2	71
72	54.3	47.2	53.5	48.2	53.3	48.3	52.7	49.1	51.8	50.0	50.9	50.9	72
73	55.1	47.9	54.2	48.8	54.1	49.0	53.4	49.8	52.5	50.7	51.6	51.6	73
74	55.9	48.5	55.0	49.5	54.8	49.7	54.1	50.5	53.2	51.4	52.3	52.3	74
75	56.6	49.2	55.7	50.2	55.6	50.4	54.8	51.1	53.9	52.1	53.0	53.0	75
76	57.4	49.9	56.5	50.9	56.3	51.0	55.6	51.8	54.7	52.8	53.7	53.7	76
77	58.1	50.5	57.2	51.5	57.1	51.7	56.3	52.5	55.4	53.5	54.4	54.4	77
78	58.9	51.2	58.0	52.1	57.8	52.4	57.0	53.2	56.1	54.2	55.2	55.2	78
79	59.6	51.8	58.7	52.8	58.5	53.0	57.8	53.9	56.8	54.9	55.9	55.9	79
80	60.4	52.5	59.4	53.5	59.3	53.7	58.5	54.6	57.5	55.6	56.6	56.6	80
81	61.1	53.1	60.2	54.2	60.0	54.4	59.2	55.2	58.3	56.3	57.3	57.3	81
82	61.9	53.8	60.9	54.9	60.8	55.1	60.0	55.9	59.0	57.0	58.0	58.0	82
83	62.6	54.5	61.7	55.5	61.5	55.7	60.7	56.6	59.7	57.6	58.7	58.7	83
84	63.4	55.1	62.4	56.2	62.2	56.4	61.4	57.3	60.4	58.3	59.4	59.4	84
85	64.2	55.9	63.2	56.9	63.0	57.1	62.2	58.0	61.1	59.0	60.1	60.1	85
86	64.9	56.4	63.9	57.5	63.7	57.7	63.0	58.6	61.9	59.7	60.8	60.8	86
87	65.7	57.1	64.7	58.2	64.5	58.4	63.6	59.3	62.6	60.4	61.5	61.5	87
88	66.4	57.7	65.4	58.9	65.2	59.1	64.4	60.0	63.3	61.1	62.2	62.2	88
89	67.2	58.4	66.1	59.6	65.9	59.8	65.1	60.7	64.0	61.8	62.9	62.9	89
90	67.9	59.0	66.9	60.2	66.7	60.4	65.8	61.4	64.7	62.5	63.6	63.6	90
91	68.7	59.7	67.6	60.9	67.4	61.1	66.5	62.1	65.5	63.2	64.3	64.3	91
92	69.4	60.4	68.4	61.6	68.2	61.8	67.3	62.7	66.2	63.9	65.0	65.0	92
93	70.2	61.0	69.1	62.2	68.9	62.4	68.0	63.4	66.9	64.6	65.8	65.8	93
94	71.0	61.7	69.9	62.9	69.6	63.1	68.7	64.1	67.6	65.3	66.5	66.5	94
95	71.7	62.3	70.6	63.6	70.4	63.8	69.5	64.8	68.3	66.0	67.2	67.2	95
96	72.5	63.0	71.3	64.2	71.1	64.5	70.2	65.5	69.1	66.7	67.9	67.9	96
97	73.2	63.6	72.1	64.9	71.9	65.1	70.9	66.1	69.8	67.4	68.6	68.6	97
98	74.0	64.3	72.8	65.6	72.6	65.8	71.7	66.8	70.5	68.1	69.3	69.3	98
99	74.7	65.0	73.6	66.2	73.4	66.5	72.4	67.5	71.2	68.8	70.0	70.0	99
100	75.5	65.6	74.3	66.9	74.1	67.2	73.1	68.2	71.9	69.5	70.7	70.7	100
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	49 Deg.		48 Deg.		4 $\frac{1}{4}$ Point.		47 Deg.		46 Deg.		4 Point.		

The Use and Explanation of the Table of Difference of Latitude and Departure.

THis is a Table larger and better contrived than any of this Nature yet extant, given the Difference of Latitude and Departure, to any distance not exceeding 100, in Minutes and Tenth-parts, to every Degree and Quarter-point of the Compass; and may be used to a greater distance, being taken out at twice or thrice according to the quantity of the distance, as shall be shown in the Use.

The Course stands at the head and foot of the Table, to every Degree and Quarter-point of the Compass; at the head it begins at 1 deg. so 2 deg. $\frac{1}{4}$ Point, &c. increasing to 45 deg. or 4 Points. At the foot it begins at 45 deg. or 4 Points, so 46 deg. 47 deg. $4\frac{1}{4}$ Points, &c. increasing backwards to 90 deg. or 8 Points. The Distance stands in the two outmost Columns, under the Title *Dist.* which on the Left-hand Page begins at 1, and runs to 50; on the Right-hand Page begins at 51, and runs to 100. The Difference of Latitude and Departure stands under the Course at the head, and over it at the foot of the Table.

The Use of the Table.

This Table is very useful in Navigation, especially in working a *Traverse*.

Example 1.

The Course and Distance given, to find the Difference of Latitude and Departure by the Table.

Suppose a Ship sails N.N.E. $\frac{1}{4}$ East, 95 min. and the Difference of Latitude and Departure required.

On the Right-hand Page (because the Distance is above 50) and at the top (because it is under 4 Points) look for 2 $\frac{1}{4}$ Points, which is the Course; under which, and against 95 the Distance, under the Title *Lat.* stands 81.5, which is 81 min. $\frac{5}{10}$ the Difference of Latitude; and under the Title *Dep.* stands 48.8, that is 48 min. $\frac{8}{10}$ which is the Departure required.

Example 2.

Suppose a Ship sail South 56° , westerly 48 min. the Difference of Latitude and Departure required.

On the Left-hand Page, (because the Distance is less than 50) and at the bottom (because it is above 45 deg.) look for 56° the Course; over which, and against 48 the Distance, over the Title *Lat.* stands 26.8, that is 26 min. $\frac{8}{10}$ the Difference of Latitude; and over the Title *Dep.* stands 39.8, that is, 39 min. $\frac{8}{10}$ the Departure required.

Example 3.

Suppose a Ship sail North-west by North 160 min. and the Difference of Latitude and Departure required by the Table. On

On the Right-hand Page at the top, look for 3 Points, the Course. Now because the Table goes but to 100, take for 100 first; therefore under 3 Points, and against 100, under the Title *Lat.* stands 83.1, that is 83 min. $\frac{1}{10}$ the Difference of Latitude; and under the Title *Dep.* stands 55.6. that is, 55 min. $\frac{6}{10}$ the Departure; then for 60, under 3 Points, and against 60, under the Title *Lat.* stands 49.9. that is 49 min. $\frac{9}{10}$ the Difference of Latitude; and under the Title *Dep.* stands 33.3, that is 33 min. $\frac{3}{10}$ the Departure, then add the Difference of Latitude and Departure for 60, to the Difference of Latitude and Departure for 100, and the Sum is 133 min. the Difference of Latitude, and 88 $\frac{9}{10}$ the Departure required.

This Table is also useful in the Resolution of the rest of the Problems of *Plain Sailing*, which for brevity sake are omitted; but the general Use of it is in the exact working of a *Traverse*.

Example 1.

Suppose a Ship bound to a certain Port, sails S. E. by South, 49 min. then E. S. E. $\frac{1}{2}$ East, 52 min. then East by North $\frac{1}{2}$ East, 62 min. then S. S. W. $\frac{1}{2}$ West, 57 min. then South $\frac{1}{2}$ East, 39 min. to find the Difference of Latitude and Departure that the Ship hath made.

Set down the several Courses and Distances; first allowing for Leeway, if any; then proceed to look out the Difference of Latitude and Departure from each Course and Distance (by the Directions before given) in the Table, placing them in their proper Columns, (*viz.*) If the Course be Northerly, the Difference of Latitude must be put in the North Column, if Southerly, in the South Column; if it be Easterly, the Departure must be put in the East Column; if Westerly, in the West Column, as was before directed: Then having framed the Table, add up the Columns of Difference of Latitude and Departure, and subtract the lesser Difference of Latitude and Departure from the greater, and the Remainder is the Difference of Latitude and Departure the Ship hath made.

The Table.

Courses.	Distance.	Diff. Lat.		Departure.	
		North	South	East	West
S. E. by S.	49		40.7	27.2	
E. S. E. $\frac{1}{2}$ E.	52		15.1	49.7	
E. by N. $\frac{1}{2}$ E.	62	06.1		61.7	
S. S. W. $\frac{1}{2}$ W.	57		50.3		26.8
S. $\frac{1}{2}$ E.	39		38.8	03.8	
		06.1	44.9	142.4	26.8
			6.1	26.8	
			138.8	115.6	

The whole Difference of Latitude is 138 $\frac{8}{10}$ South, the Departure 115 $\frac{6}{10}$ East.

Example.

Example 2.

The Courses being given in Degrees, which often happens by reason of allowance for the Variation of the Compass, and in the like Cases.

Suppose a Ship bound to a certain Port, sails North Westerly 34°, Min. (or Miles) 65. Then North-west 67°, Min. 56. Then South-west 78°, Min. 48. Then North-east 23°, Min. 54. Then North-east 6°, Min. 36 and the Difference of Latitude and Departure required.

The Table.

Courses.	Distance.	Diff. Lat.		Departure.	
		North.	South.	East.	West.
N. W. 34°	65	53.9			36.3
N. W. 67°	56	21.9			51.5
S. W. 78°	48		10.0		47.0
N. E. 23°	54	49.7		21.1	
N. E. 06°	36	35.8		03.8	
		161.3	10.0	24.9	134.8
		10.0			24.9
		151.3			109.9

The whole Difference of Latitude is 151 $\frac{1}{2}$ North, the Departure 109 $\frac{1}{2}$ West.

Some necessary Astronomical Definitions.

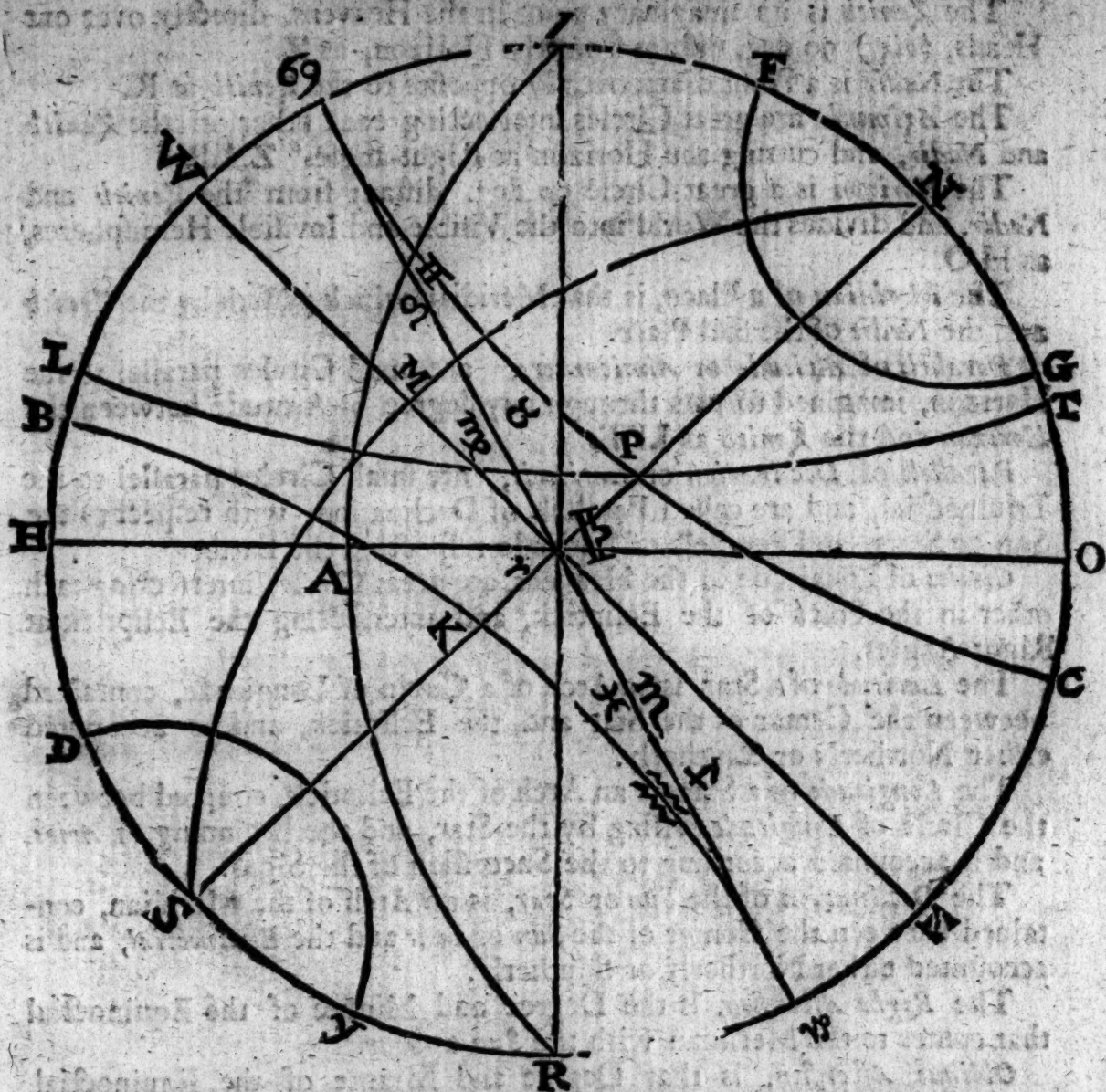
THE Poles of the Equinoctial (commonly called the Poles of the World) are two fixed Points in the Heavens, opposite one to another; the one visible to us, called the *North Pole*, marked with the Letter N; the other not visible to us, called the *South Pole*, marked with S.

The *Axis* of the World is a Line imagined to pass from Pole to Pole about which is performed the Diurnal Revolution.

The *Equinoctial* is a great Circle 90 deg. distant from the Poles of the World, and divides it into the North and South Hemispheres; it is noted by the Letters E. W.

The *Ecliptick* is a great Circle intersecting the Equinoctial in two opposite Points, the beginning of *Aries*, and the beginning of *Libra*, and makes an Angle therewith of 23 deg. 30 min. It is divided into 12 Signs, each containing 30 deg. which are as follows.

<i>Aries</i>	♈	} are Northern Signs.	<i>Libra</i>	♎	} are Southern Signs.
<i>Taurus</i>	♉		<i>Scorpio</i>	♏	
<i>Gemini</i>	♊		<i>Sagittarius</i>	♐	
<i>Cancer</i>	♋		<i>Capricornus</i>	♑	
<i>Leo</i>	♌		<i>Aquarius</i>	♒	
<i>Virgo</i>	♍		<i>Pisces</i>	♓	



The *Ecliptick* is noted by the Characters of the Twelve Signs.

The Poles of the *Ecliptick* are two Points, $23^{\circ} 30'$ from the Poles of the *Equinoctial*, represented by G and D.

The *Zodiack* is a *Zone*, having about 9 Degrees of Latit. on either side of the *Ecliptick*, and limits the Lat. of the Planets in their Revolutions.

The *Meridians* are great Circles intersecting each other in the Poles of the World, and cutting the *Equinoctial* at Right angles, NMS

The *Tropicks* are two small Circles, $23^{\circ} 39'$ distant from the *Equinoctial*, being parallel thereto, and are the Limits of the Sun's greatest Declination; the Northern Tropick being marked with $\odot$ C, called the Tropick of *Cancer*; the Southern, called the Tropick of *Capricorn*, and marked with $\text{B } \text{vs}$.

The *Polar Circles* are two small Circles $23^{\circ} 30'$ distant from the Poles of the World, being parallel to the *Equinoctial*, as FG, and DY.

Q

The

The *Zenith* is an imaginary point in the Heavens, directly over our Heads, (*viz.*) 90 deg. distant from the Horizon, as Z.

The *Nadir* is a Point diametrically opposite to the *Zenith* as R.

The *Azimuths* are great Circles intersecting each other in the *Zenith* and *Nadir*, and cutting the Horizon at Right-angles' Z.A.R.

The *Horizon* is a great Circle 90 deg. distant from the *Zenith* and *Nadir*, and divides the World into the Visible and Invisible Hemispheres, as H.O.

The *Meridian* of a Place, is that Meridian which passeth by the *Zenith* and the *Nadir* of the said Place.

Parallels of Altitude or *Almicanters*, are small Circles parallel to the Horizon, imagined to pass through any degree of Altitude between the Horizon and the *Zenith* as LPT.

Parallels of Declination or *Latitude*, are small Circles parallel to the Equinoctial, and are called *Parallels of Declination*, with respect to the Sun or Stars, and *Parallels of Latitude* respecting the Earth.

Circles of Longitude in the Heavens, are great Circles intersecting each other in the Poles of the Ecliptick, and intersecting the Ecliptick at Right-Angles.

The *Latitude* of a Star, is an Arch of a Circle of Longitude, contained between the Center of the Star and the Ecliptick, and is accounted either Northerly or Southerly.

The *Longitude* of a Star, is an Arch of the Ecliptick, counted between the Circle of Longitude passing by the Star, and the beginning of *Aries*, and is accounted according to the Succession of the Signs.

The *Declination* of the Sun or Star, is an Arch of the Meridian, contained between the Center of the Sun or Star and the Equinoctial, and is accounted either Northerly or Southerly.

The *Right Ascension*, is the Degree and Minute of the Equinoctial that comes to the Meridian with the Sun or Star.

Oblique Ascension, is that Degree and Minute of the Equinoctial, that riseth with the Center of the Sun or Star.

Oblique Descension, is the Degree and Minute of the Equinoctial, that sets with the Sun or Star.

Ascensional Difference, is an Arch of the Equinoctial contained between the Right and Oblique Ascension, or Descension.

The *Amplitude*, is an Arch of the Horizon, being the Distance of the rising or setting of the Sun or Star from the East and West, and is accounted either Northerly or Southerly.

The *Latitude* of a Place, is the height of the Pole above the Horizon, or the distance between the *Zenith* and the Equinoctial.

Longitude on the Earth, is an Arch of the Equinoctial, contained between the Meridian of the place where the Longitude is assigned to begin, and the Meridian of any other Place, and is accounted Easterly.

Astronomical Problems useful in Navigation.

P R O B. I.

THE Sun's place and greatest Declination given, to find its present Declination.

Example.

Suppose the Sun's Place to be $20^{\circ} 30'$ of *Gemini*, the greatest Declination is $23^{\circ} 30'$; it's required to find the present Declination.

The Operation by the Logarithms.

As Radius	10.0000000
To S. Sun's great Declination $23^{\circ} 30'$	9.6006997
So is S. Sun's Distance $80^{\circ} 30'$ from <i>Aries</i> to <i>Libra</i>	9.9940190
To S. Sun's present Declin. required, which is Nor. $23^{\circ} 11'$	9.5053176

By the Gunter.

The extent from Radius S. 90° , to S. $23^{\circ} 30'$, shall reach from S. $80^{\circ} 30'$, to S. $23^{\circ} 11'$, the Declination required.

Note. The Sun's Distance is reckoned from the next Equinoctial Point: Therefore if the Sun be in *Aries*, *Taurus*, *Gemini*, *Capricornus*, *Aquarius*, *Pisces*, the Distance is accounted from *Aries*; but if in *Cancer*, *Leo*, *Virgo*, *Libra*, *Scorpio*, or *Sagittarius*, it is accounted from *Libra*.

Aries, *Taurus*, *Gemini*, *Cancer*, *Leo*, *Virgo*, are called northern Signs; *Libra*, *Scorpio*, *Sagittarius*, *Capricornus*, *Aquarius* and *Pisces*, are called Southern Signs. Consequently if the Sun's Place be in any of the first six, the Declination is Northerly; but if in any of the latter six, the Declination is Southerly.

P R O B. II.

The Sun's greatest Declination and present Declination given, to find its Place.

Example.

The Sun's greatest Declination is $23^{\circ} 30'$; the present Declination suppose to be $18^{\circ} 30'$ North increasing, and the Sun's Place required.

By the Logarithms.

As S. of the Sun's greatest Declination $23^{\circ} 30'$	9.6006997
To Radius	10.0000000
So is S. of the present Declination $18^{\circ} 30'$ North	9.5014764
To the S. Sun's Place in the Ecliptick required $52^{\circ} 43'$	0.9007767

That is one Sign (30° making a Sign) and $22^{\circ} 43'$ from *Aries*, because the Declination is North, and encreasing, that is, in $22^{\circ} 43'$ of *Taurus*; but if the Declination had been decreasing, it must have been accounted from *Libra*, and then it would have been $70^{\circ} 17'$ in *Leo*.

Astronomical Problems.

By the Gunter.

The extent of the Compasses from the S. $23^{\circ} 30'$, the greatest Declination, to Radius S. 90° , shall reach from S. $18^{\circ} 30'$, the Sun's present Declination, to the S. Sun's Place $52^{\circ} 43'$ required.

P R O B. III.

The Sun's Place and greatest Declination given, to find the Right Ascension.

Example.

Suppose the Sun's Place to be $10^{\circ} 30'$ in *Aquarius*, and the Right Ascension required.

The Operation by the Logarithms.

As Radius	10.0000000
To Tang. of the Sun's distance from <i>Aries</i> $49^{\circ} 30'$	10.0685011
So is Sc. of the greatest Declination $23^{\circ} 30'$	9.9623978
To Tang. of Right Ascension required $47^{\circ} 2'$	10.030989

By the Gunter.

The extent from Radius S. 90° , to Sc. of the greatest Declination $23^{\circ} 30'$, shall reach from Tang. Sun's Distance from *Aries* $49^{\circ} 30'$, to Tang. Right Ascension $47^{\circ} 2'$ required.

Note. This Proposition gives the Right Ascension from the next Equinoctial Point; but it ought to be accounted from *Aries*, according to the Order and Succession of the Signs; and therefore in this Case $47^{\circ} 2'$ subtracted from 360° , gives $312^{\circ} 58'$ the Right Ascension required.

P R O B. IV.

The Latitude of a Place, and the Sun's Declination given, to find the Sun's Amplitude.

Example.

Suppose the Latitude $51^{\circ} 32'$ North, and the Sun's Declination $15^{\circ} 20'$ North, and the Amplitude required.

The Operation by the Logarithms.

As Sc. of the Latitude $51^{\circ} 32'$	9.7938317
To Radius	10.0000000
So is S. of the Declination $15^{\circ} 20'$ North	9.4223176
To S. of the Amplitude required, which is $25^{\circ} 9'$	9.6284859

By the Gunter.

The extent from Sc. of the Latitude $38^{\circ} 28'$ to the S. of the Declination $15^{\circ} 20'$ North, shall reach from Radius S. 90° to S. Amplitude $25^{\circ} 9'$ North required.

Note. If the Declination be Northerly, the Amplitude is Northerly; if the Declination be Southerly, the Amplitude is also Southerly.

PROB.

Astronomical Problems.

125

P R O B. V.

The Latitude of a Place, and the Sun's Declination given, to find the Ascensional Difference.

Example.

Suppose in the Latitude of 51 deg. 32 min. North, the Sun's Declination is 10 deg. 45 min. North, and the Ascensional Difference required.

The Operation by the Logarithms.

As Tangent Complement Latitude $51^{\circ} 32'$	9.9000852
To Radius	10.0000000
So is Tang. of the Sun's Declination $10^{\circ} 45'$	9.2784242
To S. of the Ascensional Difference $13^{\circ} 49'$ required	9.3783390

By the Gunter.

The extent from Tang. 38 d. 28 m. to Tang. 10 d. 45 m. shall reach from Radius S. 90 d. to S. 13 deg. 49 min. required.

P R O B. VI.

To find the Oblique Ascension or Descension.

First, Find the Ascensional Difference by the fifth Problem.

Secondly, The Right Ascension by the third Problem.

Then if the Sun's Declination be Northerly, the Ascensional Difference subtracted from the Right Ascension, gives the Oblique Ascension, and added thereto, the Oblique Descension. But if the Sun's Declination be Southerly, the Ascensional Difference added to the Right Ascension gives the Oblique Ascension, and subtracted, gives the Oblique Descension.

Note, That if the Ascensional Difference exceed the Right Ascension, add to the Right Ascension 360 deg. and then subtract the Ascensional Difference therefrom.

Or if both being added together exceed 360, the Excess is the Oblique Ascension, or Descension required.

P R O B. VII.

To find the time of the Sun's rising or setting, and length of the Day.

Find the Ascensional Difference by the fifth Problem.

Which converted to Hours and Minutes of Time, accounting for 15 d. of the Equinoctial one Hour, and for every deg. less than $(15^{\circ}) 4'$ of time; and for every 15 Minutes of the Equinoctial, 1 Minute of time.

If the Sun's Declination be Northerly, the Ascensional Difference added to six Hours, gives the time of Sun-setting; and subtracted, the time of Sun-rising.

If the Declination be Southerly, contrarily the Ascensional Difference added, gives the time of Sun-rising; subtracted, the time of Setting.

The time of Sun-setting, doubled, gives the length of the Day; the time of Sun-rising, doubled, the length of the Night.

Example

Astronomical Problems.

Example.

In Lat. $51^{\circ} 32'$ North, suppose the Sun's Declin. $21^{\circ} 57'$ North. h. m.
The Ascensional Diff. is $30^{\circ} 29'$, which reduced, is 2 hours 2 min. fere 6 0

Time of Sun-setting	Added	2	2
Time of Sun-rising		8	2
Length of the Day		3	58
Length of the Night		16	4
		7	56

P R O B. VIII.

The Latitude of the Place, the Sun's Altitude and Declination given, to find the Azimuth.

Example 1. In the Latitude $51^{\circ} 32'$ North, suppose the Sun's Declination to be $20^{\circ} 30'$ North, the Altitude $47^{\circ} 30'$, and the Azimuth required.

The Rule.

Take the Complement of the Altitude, the Compl. of the Latitude, and the Compl. of the Declination to 90 deg. add them together, and take the Half-sum; subtract the Compl. of the Declination from the Half-sum, and take the Remainder, then set down the Compl. Arithmetical of the Sines of the Compl. Altitude, and Compl. Latitude, and thereto add the Sines of the Half-Sum and Remainder; half the Sum of these Four Logarithms, in the Sc. or half the Azimuth required.

Note. If the Declination be South in North Lat. or North in South Lat. instead of taking the Compl. of the Declination to 90 deg. there must be 90 deg. added thereto, and then proceed as before.

Operation by the Logarithms

S.	42	30	Compl. Altitude	Comp. Arith.	0.1703167
S.	38	28	Compl. Latitude	Comp. Arith.	0.2061683
	69	30	Compl. Declination.		
	150	28	Sum		
S.	75	14	Half-sum		9.9854138
S.	5	44	Excess of the Half-sum above Comp. Declin.		8.9995595
			Sum		19.3614538
			Sc. of 61 21	Half-Sum	9.6807291
			61 21		

Which doubled 122 42 is the Sun's Azim. from the Nor. required.

The Operation by Gunter's Scale.

The extent of the Compasses from Radius S. 90°, to the S. $42^{\circ} 30'$ the Complement of the Altitude, shall reach from S. $38^{\circ} 28'$ the Complement of the Latitude, to the S. $24^{\circ} 40'$; then the extent from S. $24^{\circ} 40'$ to S. $75^{\circ} 14'$ the Half-sum, shall reach from S. $5^{\circ} 44'$ the excess of the Half-sum, above the Complement Declination, to $122^{\circ} 42'$ (upon the Line of veried Sines) which is the Azimuth required.

Example

Example 2.

In the Latitude $51^{\circ} 32'$ North, the Sun's Declination is $18^{\circ} 15'$ South, the Altitude $17^{\circ} 15'$ and the Azimuth from the North required.

The Operation by the Logarithms.

S. $72^{\circ} 15'$	Compl. Altitude	Comp. Arith. 0.0211025
S. $38^{\circ} 28'$	Comp. Latitude	Comp. Arith. 0.2051683
108 15	Declination, 90° deg. being added, because South.	
218 58	Sum	
S. 109 29	Half-Sum, Compl. to 180° , is $70^{\circ} 31'$	9.9743913
S. 1 14	Remainder	8.3329243
		Sum 18.5346764
Sc. of $79^{\circ} 20'$		Half-Sum 9.2673332
79 20		

Which doubled $158^{\circ} 40'$, is the Azimuth from the North required.

By the Gunter.

The extent from Radius 90° , to the S. $72^{\circ} 15'$ the Complement Altitude shall reach from the S. $38^{\circ} 28'$ the Complement Latitude, to the S. $36^{\circ} 20'$; then the extent from the S. $36^{\circ} 20'$, to S. $70^{\circ} 31'$ the Complement of $109^{\circ} 29'$ (the half-sum) to 180° , shall reach from the Remainder S. $1^{\circ} 14'$, to $148^{\circ} 40'$ (upon the Line of versed Sines) the Azimuth required.

In South Latitude, the Operation is the same with the two preceeding Examples, only the Azimuth is found from the South.

After the same manner you may find the Azimuth of any Star.

P R O B. IX.

The Latitude of the Place, the Sun's Declination and Altitude being given, to find the Hour of the Day.

Example.

In the Latitude $51^{\circ} 32'$ North, suppose the Sun's Declination $23^{\circ} 30'$ North, the Altitude $36^{\circ} 30'$ in the Afternoon, and the Hour from Noon required.

The Rule.

Take the Complement of the Declination, the Complement of the Latitude, and the Complement of the Altitude to 90° , add them together, and take the Half-Sum, subtract the Complement of the Altitude from the Half-Sum, and take the Remainder; then set down the Complement Arithmetical of the Sine of the Complement Declination, and Complement Latitude, and thereto add the Sines of the Half-Sum and Remainder: Half the Sum of these four Logarithms, is the Sc. of half the Time required in Degrees and Minutes of the Equinoctial.

The Operation by the Logarithms.

S. 66	30	Compl. Declination	Comp. Arith. 0.0376122
S. 38	28	Compl. Latitude	Comp. Arith. 0.2061683
59	30	Compl. Altitude	
158	28	Sum	
S. 79	28	Half-sum	9.9922866
S. 25	44	Remainder	9.6376731
		Sum	19.8737352

Sc. of 30 09 ————— Half-Sum 9.9368651
 30 09

Which doubled 60 18 and reduced into Time, makes 4 hours 1 min. $\frac{1}{2}$, the Time required.

But if it had been in the Forenoon, 4 hours 1 min. $\frac{1}{2}$ subtracted from 12 hours, leaves 7 hours 58 min. $\frac{1}{2}$ for the time.

If the Declination had been southerly, then instead of taking the Complement of the Declination to 90 deg. there must be 90 deg. added thereto, as in the second Example of the eighth Problem; do the same when the Declination is North in South Latitude.

By the Gunter.

The extent of the Compasses from Radius S. 90 d. to S. 66. d. 30 m. the Complement of the Declination, shall reach from S. 38 d. 28 m. the Complement Latitude, to S. 34 d. 40 m. then the extent from S 34 d. 40 m. to the S. of 79 d. 14 m. the Half-Sum, shall reach from the Remainder S. 25 d. 44 m. to 60 d. 18 m. (upon the Line of versed Sines) required.

P R O B. X.

Having the Latitude of the Place, the Sun's Right Ascension, with the Right Ascension, Declination, and Altitude of a Star given, to find the Hour of the Night.

Example.

In the Latitude 51 deg. 32 min. North, on the 7th of January 1695, the Sun's Right Ascension is 20 hours, the Right Ascension of the Lyons Tail is 11 hours 32 min. the Declination 16 deg. 25 min. North, the Altitude 30 deg. 30 min. to the Eastward of the Meridian, the Hour of the Night required.

The Rule.

Take the Complement of the Star's Declination, the Complement of the Latit. of the Place; and the Compl. of the Star's Altitude; add them together, and take the Half-Sum; subtract the Complement of the Altitude from the Half-Sum, and reserve the remainder; then set down the Complement Arithmetical of the Sines of the Complement of the Star's Declination, and of the Latitude of the Place, and thereto add the Sines of the half-sum and Remainder: Half the Sum of these four Logarithms, is the Sc. of half the Star's Distance from the Meridian.

The

The Operation by the Logarithms.

S. 73	35	Compl. Star's Declination	Comp. Arith. 0.0180764
S. 38	28	Compl. Latitude	Comp. Arith. 0.2061683
59	30	Compl. Star's Altitude	
171	33	Sum	
S. 85	46	Half-sum	9.9988135
S. 26	16	Remainder	9.6459619
		Sum	19.8690201

Sc. of 30 41 ————— Half-Sum 9.9345100
30 41

Which doubled is 61 22 which reduced into Time, gives 4 hours 5 minutes $\frac{1}{2}$ almost.

By the Directions given in the use of the Table of the Sun's Right Ascension, and of the Right Ascension and Declination of the Fixed Stars; find the time of the Stars coming upon the Meridian; if the Star be to the Eastward of the Meridian, subtract the Stars Distance from the Meridian in time, from the time of the Stars coming upon the Meridian; but if the Star be to the Westward of the Meridian, add the Stars Distance from the Meridian, to the time of the Stars coming on the Meridian, the Sum or Difference is the hour of the Night. In this Example the Sun's Right Ascension 20 h. 0 min. subtracted from the Stars Right Ascension (with 24 ho. added thereto) 35 ho. 32 min. leaves 15 ho. 32 min. the time of the Stars coming on the Meridian; from which subtracting 4 ho. 1 min. $\frac{1}{2}$, leaves 11 ho. 30 min. $\frac{1}{2}$ the hour of the Night.

Note further; If the Star's Declination be South in North Latitude, or Declination North in South Latitude, instead of taking the Complement Declination to 90 deg. there must be 90 deg. added thereto, as hath been shown in the eighth preceeding Problem.

The Operation by the Gunter's Scale.

The extent of the Compasses from Radius S. 90, to the S. of 73 deg. 35 min. the Complement of the Star's Declination, shall reach from S. 38 deg. 28 min. the Complement of the Latitude, to the S. of 36 deg. 40 min. then the extent from S. 36 deg. 40 min. to S. 85 deg. 46 min. the Half-sum, shall reach from S. 26 deg. 16 min. the Remainder to 61 deg. 22 min. (upon the Line of versed Sines) required: With which proceed as hath been directed, to find the hour of the Night.

Courses and Distances of Some of the most eminent Places on the Coast of England, Scotland and Ireland, France, Spain, and Portugal. As also the Thwart Courses between the East Coast of England and Holland, the South Coast of England and France, and the West Coast of England and Ireland.

The East Coast of England and Scotland.

	Leag.
F rom the North-Foreland to the South-end of Goodwin E. by S. ————	01 $\frac{1}{2}$
From the North-Foreland to Kentish-Knock, N.N.E. ————	06
From the North-Foreland to Orfordness, North ————	16
From the Galloper to Orfordness, N.W. by N. ————	10
From Leystaff to Yarmouth, North ————	02
From Yarmouth to Winterton N. by W. ————	04
From Corner to Blackney, W.N.W. ————	03 $\frac{1}{2}$
From Blackney to Burnham within the Sand, West ————	06 $\frac{1}{2}$
From the Spurn to Flamborough-Head, N. by W. ————	07
From Scarborough to Whitby, N.W. by N. ————	05
From Whitby to Tinnmouth, N.W. by N. ————	14
From Tinnmouth to Coquet-Island, N. by W. ————	07
From the Staples to Berwick, W.N.W. ————	05 $\frac{1}{2}$
From the Staples to St. Abbs-Head, N.W. ————	10
From Aberdeen to Bockness, N.E. ————	07
From Bockness to Catness, N.W. ————	27

Thwart Courses from England to Holland, &c.

From the North-Foreland to Flushing, East ————	24 $\frac{1}{2}$
From the South-Foreland to the Texel, N.E. ————	52
From Orfordness to the Texel, E.N.E. ————	39
From the Spurn to the Texel, E. by S. ————	56
From Tinnmouth to the Naze of Norway, N.E. by E. ————	120
From Tinnmouth to Holy-Land, E. by S. ————	118
From Tinnmouth to the Scaw, E.N.E. ————	150
From Yarmouth to the Texel, E. by N. ————	34
From New-Castle to Mares-deep, E.N.E. ————	83
From Aberdeen to Mares-deep, S.E. ————	113
From Dover to the Maes, N.E. by E. ————	32
From the North-Foreland to the Maes, E.N.E. ————	30
From Newcastle to the Fly, E.S.E. ————	90
From Scarborough to Holy-Land, East Northerly ————	97

The

Courses and Distances.

130

The South Coast of England.

From Dover to Dungeness, S. W. by W.	06
From Dungeness to Fairlee, W.S.W.	03 $\frac{1}{2}$
From Fairlee to Beachy, W.S.W.	05
From Beachy to the Owers, West by South	13
From Beachy to St. Hellens, W. by S.	18
From Needles of the Wight to Portland, W.S.W.	11
From Portland to Torbay, West-Southerly	12
From Portland to the Start, W.S.W.	16 $\frac{1}{2}$
From the Start to the Ramhead N.W. by W.	07
From Falmouth to the Lizard, South by West	04
From the Start to the Eddystone, West $\frac{1}{2}$ North	08
From the Start to the Lizard, W. by S.	20
From the Lizard to the Lands-end, W.N.W.	09
From the Lands-end to Silly, W.S.W.	08

Towards Courses from the South Coast of England to France.

From the Casquets to Blacknefs, E.N.E.	56 $\frac{1}{2}$
From Beachy to Blacknefs, East	20
From the Isle of Wight to Diep E.S.E.	37
From Dover to Diep, South	24 $\frac{1}{2}$
From Portland to Seynhead, S.E. by E.	42
From Beachy to Struyfart, S. by E.	24
From Dover Point to Struyfart, N. by E.	34 $\frac{1}{2}$
From Beachy to the Casquets, S.W. by W. Westerly	37
From Portland to the Casquets, S. by E.	16
From Silly to the Casquets, East Southerly	56
From the Lizard to Guernsey, E. by S.	40
From the Start to Seven Isles, S. by E.	26
From the Lizard to Paul de Lion, S.E. by S.	29
From Portland to Paul de Lion, S.W. by S.	40
From Silly to Ushant, S.E. by S.	37
From the Lizard to Ushant, South	29
From the Start to Ushant, S.W. by S.	38
From Portland to Ushant, S.W.	53

The West Coast of England.

From Silly to the Cape of Cornwall, N.E. by E.	08
From the Cape of Cornwall to St. Ives, E. by N.	06
From St. Ives to Stoopert Point N.E. by E.	09
From Stoopert to Hartland Point, N.E. by N.	09
From St. Ives to Hartland Point, N.E.	18 $\frac{1}{2}$
From Hartland Point, to the Isle of Lundy, North	04
From the West-end of Lundy to Biddisford, E.S.E.	05
From Lundy to the Holms, E. by N.	20
From Steepholm to the River of Bristol, E.N.E.	17

Courses and Distances.

From Steepholm to the Naze, E. by S. —————	06½
From the Naze to St. Gawens Point, West Northerly —————	17
From St. Gawens Point to Milford Haven, N.W. by N. —————	04
From the Island Scalm to Ramsey, N.N.W. —————	01½

The Coast of Ireland.

From the South end of the Saltees to Black Rock, N.E. by E. —————	02½
From the Saltees to Tuscar, E.N.E. —————	05
From Black Rock to Tuscar, E.N.E. —————	03
From Arkelow to the Mizan Head, N. by E. Easterly —————	02½
From Newcastle to the Point of Brahe, North Westerly —————	02
From Brahe-Head to the Island Dalk, North by West —————	02½
From Dalk to the Bar of Dublin, N.N.W. —————	02
From the North and South Rock to Copeland Isles, N.N.W. —————	06½
From the Island Tore to the Isles of Arran, S.W. by S. —————	09
From Telling-head to Kilbegh, E.S.E. —————	05
From Black Rock to Ackle Head, S.E. —————	01
From Slyne-head to Galloway Bay, S.E. —————	09
From the Bay of Galloway to Blasques, S.W. by S. —————	21
From Dingle-haven to Shellocks, S.W. by S. —————	07
From Cape Dorsey to Mizan-head, E.S.E. —————	08
From Sheeps-head to Beer-haven, N. by W. —————	02½
From Beer-haven to the Island Whiddy, E.N.E. —————	08
From Mizan-head to Cape Clare, East by South —————	06½
From Cape Clare to Old-head, East by North —————	13
From Old-head to the Haven of Kinsale, North by East —————	01½
From Old-head to Cork, N.E. by East —————	05
From Cork to Waterford, E.N.E. —————	19

Thwart Courses from England to Ireland.

From Grosholm to Waterford, W. by N. —————	21
From the Rocks Smales to Tuscar, N.W. by N. —————	10½
From the Lands-end of England to Tuscar N. by W. —————	40
From the Lands-end of England to Waterford, N.N.W. —————	40
From Holy Hill in the Island of Anglesey to the Bar of Dublin, W. by N. —————	18½
From Rockol to Black Rock, S. by E. —————	80
From Silly to Cape Dorset, N.W. by W. —————	56
From the Lands-end of England to Cape Clare, N.W. by W. —————	53
From Silly to Cape Clear, N. W. —————	46
From the Land's-end of England to Old-head, N.W. —————	45

The Coast of France, Spain, and Portugal.

From the Fourn to St. Matthews Point, S.S.E. —————	04
From St. Matthews Point to the Race of Fountney, S. by E. —————	08
From Gloyland to Bell-Isle, S.E. by E. —————	12
From the West Pens to Bell-Isle, E.S.E. —————	21

From

Courses and Distances.

133

From the E. Point of the Cardinal to the Mouth of <i>Morbean</i> , N.N.W.	06
From <i>Armentiers</i> to the West-end of <i>Use</i> , S. by W.	07
From the East-end of <i>Bell-Isle</i> to <i>Use</i> , S. E. Easterly	16
From <i>Use</i> to <i>Oleron</i> , S.E. by E.	16
From <i>John de Lux</i> to <i>St. Sebastians</i> , West	08
From <i>Cape Martinchaco</i> to <i>Bilboa</i> , S.S.W.	06½
From the Point of <i>Bilboa</i> to <i>Castro</i> , West	05
From <i>Bilboa</i> to <i>St. Anthony</i> , W. by N.	08
From <i>St. Anthony</i> to the West Point of <i>Andero</i> , West	05
From <i>Andero</i> to <i>Cape de Pinas</i> , West Northerly	28
From <i>Cape Pinas</i> to <i>Ribadeus</i> , S.W. by W.	12
From <i>Cape Pinas</i> to <i>Ortegal</i> , W. by N. Westerly	24
From <i>Siverus</i> to <i>Cape de Prior</i> , S.W.	05
From the <i>Groin</i> to <i>Cisarga</i> , West	08
From <i>Cisarga</i> to <i>Cape de Bylem</i> , S.W. by W.	12
From <i>Cape de Bylem</i> to <i>Cape Coriane</i> , S.W.	02½
From <i>Cape Coriane</i> to <i>Finisterre</i> , South	02½
From <i>Cape Ortegal</i> to <i>Cape Coriane</i> , S. W. by W.	33
From <i>St. Sebastian</i> to <i>Bell-Isle</i> , N.N.W.	75
From <i>Cape Martinchaco</i> to <i>Arcazon</i> , N.E. Easterly	28
From <i>Cape Martinchaco</i> to <i>Use</i> , N. by E.	52
From <i>Cape Pinas</i> to the Tower of <i>Cordan</i> , E.N.E. Easterly	66
From <i>Cape Pinas</i> to <i>Bell-Isle</i> , N.N.E.	74
From <i>Cape de Ortegal</i> to <i>Waterford</i> in <i>Ireland</i> , North	160
From <i>Cisarga</i> to <i>Silly N.</i> by E.	137
From <i>Cape Finisterre</i> to <i>Port O Port</i> , S.S.E.	44
From <i>Cape Finisterre</i> to <i>Avero</i> , S. by E.	53
From <i>Cape Finisterre</i> to the <i>Burlings</i> , South ½ East	74
From <i>Port O Port</i> to <i>Avero</i> , South	10
From <i>Cape Montego</i> to the <i>Burlings</i> , S.W.	20
From the <i>Burlings</i> to <i>Roxent</i> , S. by E. Easterly	16
From <i>Cape Pitcher</i> to <i>Cape St. Vincent</i> , South Easterly	32
From <i>Cape Finisterre</i> to the <i>Lizard</i> , N.N.E.	150
From <i>Villa Nova</i> to <i>Cape St. Maries</i> , E. by S.	09
From <i>Cape St. Maries</i> to <i>Saltees</i> , E.N.E.	24
From <i>Cape St. Vincent</i> to <i>Cape St. Maries</i> , East	18½
From <i>St. Lucas</i> to the Point of <i>Cales</i> , S.E.	10
From <i>Cales</i> to the <i>Straits-mouth</i> , S.S.E.	10
From the Point of <i>Gibraltar</i> to <i>Malaga</i> , N.E.	24
From <i>Malaga</i> to <i>Veles Malaga</i> , East Northerly	06½
From the Point of <i>Gibraltar</i> to <i>Cape de Gat</i> , E. by N.	66
From <i>Cape St. Vincent</i> to <i>Cape Cantin</i> , South	86
From <i>Cape St. Vincent</i> to <i>Cape de Geere</i> , South Westerly	133
From <i>Cape St. Maries</i> to the <i>Straits</i> , E.S.E. Southerly	49
From <i>Cape St. Maries</i> to <i>Cape Cantin</i> , E. by W.	90

A Table of the Soundings coming into the Channel, respecting the Bearings and Distances from Silly, Ushant, the Lizard, &c. With the Various sorts of Ground.

Bearings.	Dist.	Lat. D.M.	Dep.	The various sorts of Ground.
South.	05	50.20	50	Branny sand like ground Wheat.
S.S.E.	05	50.12	45	White sand mixed with shells.
S.S.E.	62		50	Coarse Owse.
E.S.E.	06		53	Coarse sand and fine red shells.
E. by S.	08	50.12	58	Owsey sand with Queen-shells amongst it.
E. by N.	07	49.15	72	Owse like Mustard seed with broken shells.
E. by N.	15	48.50	72	Peppery sand black and yellow.
E. by N.	25	49.50	72	Black, white and red stones with Owse.
E. N. E.	07	49.15	60	Some black sand.
E. N. E.	20	49.15	80	Rocky ground.
E. N. E.	55		103	Fine white sand.
N.E. by E.	22	49.10	85	Sand and Owse together.
N.E. by E.	10	49.20	55	White and red sand mixed with shells.
N.E. by E.	50	49.50	100	White sand with Owse and Nirs.
N.E. by E.	25	49.50	64	Branny sand with white and red shells.
N.E. by E.	06	49.10	48	Black sand.
N.E. by E.	13	49.43	65	Branny sand with some pieces of shells.
N. E.	10	49.40	65	Branny sand, Herring bones, small stones.
N.E. by N.	10	49.20	57	Small red sand.
N.N.E.	100	49.47	102	White sand then entering on the Bank.
N. by E.	18		68	Red sand with black & white scollop shells.
North.	12	49.15	65	Broken shells with white and red sand.
North.	10	49.47	65	White sand on the East part of the Bank.
N.N.W.	33	48.52	77	Red sand and shells amongst it.
N.W. b. N.	07	49.40	54	More shells, the <i>Lizard</i> N.E. dist. 18 leag.
N.W.	04	50.10	50	Branny sand with black and broken shells.
N.W.	07	49.47	60	Stony ground.
N.W. b. W.	04	50.25	61	Red and black sand with gliftring shells.
N.W. b. W.	2½		44	Shells and sands like points of Needles.
W. by N.	13	50.25	63	Fine white sand with a little Owse.
West.	21	50.08	66	Red and black sand with gliftring shells.
W. by S.	32	49.50	75	Fine white sand and small gliftring shells.
W. by S.	3½		40	Like broken Wheat or coarse Bran.

Bearings

Bearings.		Lat.	Dep.	The various sorts of Ground.
		D.M.		
Uphant.	North.	06 48.36	63	Full of small Mace-sand.
	N. by E.	18 48.15	80	Round stones mixed with scollop shells.
	N.E. by N.	11	60	Small beaten shells and Hakes-teeth.
	N.E.	29 48.50	85	Great and small pieces of Cockle-shells.
	N.E.	25 48.10	55	Grey and brown sand with white shells.
	N.E. by E.	07 48.30	68	White and gray Mace-sand.
	E.N.E.	14 48.36	68	Small shells and Herring-bones.
	E. by N.	25 48.30	85	White and gray sand with small red stones.
	East.	18 49.00	70	Branny sand and some shells.
	East.	06 48.00	65	Red sand, shells, things like Needle Points.
	East.	15 49.15	70	Fine white sand.
	East.	33 49.15	87	Dazling sand like Barley-straw.
	East.	04 49.10	06	Full of Mace-sand and broken shells.
	E. by S.	04 48.56	63	Shells like Periwinkles.
	E.S.E.	15 49.15	70	Shells, gray and red pieces of Cockle-shells.
	E.S.E.	12 49.20	68	Gross white sand with shells.
	E.S.E.	08 49.05	64	White shells, and fine small stones.
	E.S.E.	06	60	Hakes-teeth, and shells like Oatmeal-husks
Lands end	S.E. by E.	20 49.15	72	Great stones like Beans and Peale.
	S.E. by E.	09 49.15	65	Sand and some shells.
	S.E. by E.	37 48.30	65	James's shells.
	S.E. by E.	15 49.25	60	Small scollop-shells, with small stones.
	North.	6 1/2	50	Like husks of Oatmeal, and small stones.
	N. by W.	01	30	Rocky ground.
Lizard.	N.E.	6 1/2	48	Mashy shells and some scollop-shells.
	N.E. by N.	10	53	Mashy shells and Hakes-teeth.
	N.N.E.	09	50	Mashy shells like Oatmeal-husks.
	N. by E.	15	58	Mashy shells and Hakes-teeth.
	North.	01	39	Stones as big as Beans, so four Leagues off.
	N.W.	05	45	Gray sand like Oatmeal-Flower.
	N.W.	03	43	Mashy shells and small stones.
	W.N.W.	3 1/2	45	Small shingly stones and mashy shells.
	W. by N.	04	40	White mashy shells and white stones.
	W. by S.	30	41	Black gravelly ground with small stones.
Eddy Stone.	N.E. by E.	12	57	Scollop Shells.
	N.E. by E.	04	44	Great stones and rough ground.
	N 1/2 Mile.		35	Dirty brown sand and Hakes-teeth.
	W. 2 Miles		34	Dirty brown sand.
	S. 1 Mile.		26	Fine sand, and within this 28 and 30 fathom.

Soundings coming into the Channel.

Bearings.		Dist.	Dep.	The various sorts of Ground.
Start.	N. by E. Nby.	8 $\frac{1}{2}$	40	{ Like the Dust of a Grindstone, with Hakes-teeth and shells.
	N.W. by W.	4 $\frac{1}{2}$	43	
	N. W. by N.	03	38	{ Gravelly Sand, small Stones and Shells.
	N.b.W. Wby	12	38	
	N.W. by W.	14	42	
Portland.	N. E. by E.	08	35	Small shingle stones as big as Pease.
	North.	08	40	Streamy Ground with small stones.
	N. by E.	5 $\frac{1}{2}$	33	The same with some black sand.
	N. E. by N.	11	41	Fine sand and scollop shells and small stones.
	N.N.E.	08	40	Fine sand, scollop shells.
	N.E. by E.	2 $\frac{1}{2}$	27	Shingly Ground,
	W.N.W.	2 $\frac{1}{2}$	20	Small stones.
Needles.	N. E. by E.	02	17	Great shingly Ground.
	N. E. $\frac{1}{2}$ E.	2 $\frac{1}{2}$	19	Small shingly Ground.
	N.E.	02	13	Rocky Ground.
Body of the Isle of Wight	N. by W.	3 $\frac{1}{2}$	20	{ All the Ground from <i>Albions</i> to the East end of the <i>Wight</i> is Chalkey, it makes Dents in the Tallow, and nothing comes up but brown Sand in rolls, which will crumble in your Fingers.
	E. by N.	04	21	
	N. by E.	03	18	
	North.	03	18	
	N. by W.			
Dunnofe.	W. by S.	04	16	Rough Ground with some big stones.
	West.	04	21	A kind of sandy fishing Ground.
	W.N.W.	08	33	{ Fishing Ground somewhat red, with Stones as big as Pease, and some as Beans.
	W. by N.	06	26	

Directions

Directions to sail into some of the Principal Harbours on the Coast of *England*.

Directions to sail into Silly.

Silly is divided into divers Islands ; along the West side lieth a great many Rocks. There are several Channels through which to go in ; but the Southermost, called *St. Mary's Sound*, is the best, being a fair opening of a Channel ; but near the midst lies two sunken Rocks, which in foul Weather, the Sea may be seen to break over ; it is best to leave them on the Larboard side going in, and on the Starboard coming out : Go so near the Starboard shoar, as that a Stone may be almost thrown on shoar ; and when you are within the Point, luff up round, and come to an Anchor in sight of the Houses ; or when the Town is brought open with the Valley, leave two thirds of the Harbour on the Larboard side.

Directions to sail into Mount's-Bay.

If you are bound into *Mount's-Bay* with an Easterly Wind, keep not too near the *Lizard* Shoar, especially at the *Manacles*, for without the *Manacles* there are sunken Rocks. To avoid which, be sure to keep so far off the Shoar, that all the Spire of the Steeple, called *Keveron*, may be seen above the Land ; so shall ye go clear of them unto the *Lizard* Point ; from whence there lieth a Ledge of Rocks, which all shew themselves at low water. About five Leagues N.W. from the *Lizard* lieth *Mount's-Bay* ; on the East side of which is a high Land, whereon stands a Castle called *St. Michael's Mount* ; to the Eastward of which lies a great range of Rocks from the Land, a League into the Sea, wherefore be sure to be careful in dark Weather ; from thence to the southward, towards the *Lizard*, the Coast is very full of Rocks, but lie not far off the Shoar.

To sail into *Mount's-Bay* coming from the *Lands-end*, or the *Lizard*, the Ground is very clear all over, and fine Sand unto a Mile of the Shoar, between 20 and 23 Fathom.

To sail into Foy.

To sail into *Foy*, it is necessary to have at least half-flood ; run in amidst the Channel between the two Points : And being come within, chuse either side, but the most Water is by the *Wersteland*, between the *Stakes* and the square Steeple. Being come within the *Stakes* (as you come in by Land) bear somewhat off presently from the West shoar, almost into the midst of the Channel nearest the West shoar, until you come before the Village that lieth on the West side ; where is a deep Dock, in which Ships that draw 16 foot, may lie a-float at low water ; four Ships may lie in the said Dock.

To sail into Falmouth.

Four Leagues S.W. by South from *Foy*, lieth *Deadman's Head*, and two Leagues to the Westward lieth the Haven of *Falmouth*; upon the West Point of the Haven of *Falmouth*, standeth a Castle on the high Land called *Pendennis*. In the Entry nearest the said West side, lieth a great Rock above water, you may sail in at either side of it; at the inner side of the East Point lie also some Rocks off the Shoar; on the East side is deepest Water, and most room; therefore in going in, give the East Point a large birth; there will be seven or eight fathom: Keep the said Shoar till you come within *St. Maudes* Castle; which when it bears East, there will be 16 or 17 fathom; but half the Harbour over towards *Smithick* is but 4 or 5 fathom. Observe in going in, to keep the *Manacles* open and shut on the Point of *Falmouth-Castle*; and so it must be kept till you shut the Church over *Penny-Conquick*, into the N. E. end of the *Smithick*, and so bear over to *St. Maudes*, and ride with the Castle East, laying one Anchor in 18 fathom, and the Westernmost anchor in 4 fathom, as shall seem convenient.

To sail into Plymouth.

Seven leagues to the Westward of the *Start*, lieth *Plymouth-Sound*; at the Eastermost Point of the *Sound* lieth an high round Rock, called *Mawstone*, between it and *Ramhead* lieth the said *Sound* N. N. E. being round and deep.

A little to the northward of *Ramhead* is a fair Sand Bay, where is good anchoring close under the Land, in 9 or 10 fathom. Two leagues South, a little easterly from *Ramhead*, lies a Rock above Water called *Eddy-stone*; the Point of *Plymouth* lieth from it North by East, and N.N.E. distant about 4 Leagues.

In the *Sound* by the Land of *Plymouth*, lieth an Island called *Drakes Island*, which is fast to the West side, with a range of Rocks under Water; so that you must sail along to the Eastward of it.

To sail into Catwater.

To sail into *Catwater* run in between the Island and the Point on the East side, in with the Land of *Plymouth*, till *Catwater* open on the Starboard, then go into the Eastward between the Point of *Plymouth*, and the Point on the Starboard side, leaving most part of the Channel on the Starboard side until you come within the Point; and anchor there right against the high steep Northern Land; there is at low water, with extraordinary Tides, 4 and 5 fathom.

In sailing into *Catwater*, be sure to give a good birth to the Southern Point of the Entry, for there lies off the said Point a Ledge of Rocks under Water, about two Cables length off from the Land. Upon the Point of the Ledge lies a Buoy, where is about 12 foot Water at half-flood, which Buoy must be left on the Starboard side going in; and when *Catwater* is altogether open, you may run to the eastwards, leaving in the Entry of the
Harbour

Harbour two thirds of the Channel on the Starboard, side as aforesaid, because the South Shoar is somewhat flat off, there lying a sandy Bank, which reacheth to the second Point of the South Shoar of *Catwater*.

A little to the Eastward of *Drakes-Island*, lies a Rock under Water, upon which at low water, it is no deeper than two Fathom. To sail within the Land, you may go to the Eastward or Westward of the Rock, as occasion serves.

To sail into Dartmouth.

Three or four Leagues to the Westward of *Torbay*, lies the Haven of *Dartmouth*, which hath a narrow Entry lying in between two high Lands: On each side of the Haven standeth a little Castle; on the West side is a Church on the high Land, called *St. Patrick's Church*. To sail in coming from the westward, run in along by the *Westerland*, so far to the Eastward, until the Key of the Village (on the East side of the Haven) be brought in the midst of the Entry of the Haven between the two Lands; it is convenient to have the Boat ready (if any gust of Wind should come from the high Land) to row in: Being come in, edge over to the West side before the *Brewhouse*, and anchor there in 10 or 11 fathom; or before the Village, on the East side at pleasure. At the East side lieth a sunken Rock; to avoid which, steer in with *St. Patrick's Church*, and do not bring the Village, which standeth on the West side of the Harbour, without the said Church, but keep the outer House of the said Village in the East side of the Chappel always in sight, without the Bulwark, on the North side by *St. Patrick's Church*; then there is no danger of the Rock, in the Range by the North Point. Between *Dartmouth* and the *Start* nearest to *Dartmouth*, standeth a white Spire Steeple, called *Eackman*, which is a very good Mark to know *Dartmouth* by.

To sail into Torbay,

To go into *Torbay*, bring the West Point, or the Berry, South by East, or S.S.E. from you; and anchor there in 7 or 8 fathom, where you shall be Landlocked for a South and South-west Wind. At the North-east end of the Bay is also a Tide-Haven, called the *Tormain*; before it, is very good Anchor-ground, in 4 or 5 fathom, according as is desired to be nearer or farther from the Shoar.

Directions for sailing in the East end of the Isle of Wight to Portsmouth Harbour, and also to Hampton.

If you come from the eastward with a Northerly Wind, bound into the *Isle of Wight*, or *Portsmouth*; after you are come to the Westwards of the Shoal, called the *Owers*, half in North-west with *St. Hellens Point*; but do not hale too much to the Northwards, for there lies a Bank off *Longstone Haven*, to the Eastwards of the *Horse*, that hath not above 13 foot on it at Low-water; but keeping of the Lead in 7 or 8 fathom, carrieth you clear

without it, and will bring you to the South-east end of the Sand called the *Horse*. *St. Hellens Church* being South-west by West from you, you may run in 5 fathom; and when you have brought the Westermost great white Patch, or Chalk, upon *Parch-down*, (which is the high Land to the Northwards of *Portsmouth*) a Ship's length to the westward of *South-sea Castle*, that stands upon the Beachy, then you may luff up without fear: Being then to the westward of the *Horse*, and steering with that Mark, it will lead you in alongst the *Horse* unto the Beach, and so into the Harbour of *Portsmouth*, keeping along close by the Shoar, until you come to the Town-wall's end, and there you must bear off a little for a Flat that lieth off from the Shoar; this is for an Easterly Wind. But if you intend for *Stoaks-Bay*, when you have brought the Fire-Beacon on *Brown Down*, which is to the W.N.W. of *Haslewood Point*, within a Ship's length without the said Point, then you may bear to the Westwards along the outside of the *Spitt-head*, which is the Shoal on the West side of the Entrance of *Portsmouth Haven*.

If the Wind be westerly or southerly, and you are coming from the westward, and design for *St. Hellens-Road*, or *Stoaks-Bay*, from *Dunnose* to *St. Hellens-Point*, the Course is North-east by North, and N.N.E. but borrow no nearer to *St. Hellens* than 6 or 7 fathom, for the *Spit* lies off a great way; but if it be clear Weather, that you may keep *Sand-down Castle* open of the *Culfer-Cliff*, that Mark will lead without the Spit of the Point; and steering along in this Mark, until you open *St. Hellens-Church* some two Ships length open of the *Red-Cliff* within *St. Hellens-Point*, or *Port-sea Castle*, to the Eastwards of *South-sea Castle*, then are you clear of the Point, and may steer to *St. Hellens-Road* N.W. and having brought the Point South by West, or between that and the South by East, you may anchor in 7 or 8 fathom very good Ground.

Note, That you have no good clear Ground all along the Island, until you have opened *St. Hellens-Church* as aforesaid, and have brought the Point to bear from you S.S.W.

From *St. Hellens-Point*, to go between *Noman's-land* and the *Horse*, the direct Course in, is N.W. by N. and North west; but you have no shoaling upon the South west side of *Noman's-land*, for you shall have 16 fathom, and the next Cast but 3; but at the *Horse* you may stand in 10, 9, or 8 fathom: If the strong Tides be spent, and smooth Water, you shall have a great washing of them by the overfal of the Water; but especially on *Noman's-land* if it be clear Weather. There are very good Marks to lead you in, which are as follow, keep the two Windmills on the Downs on the *Isle of Wight*, that they may be seen clear over all the Trees between you and them, but no more above them than even clear; and this Mark will lead you in, and so up along the Island without some middle Ground that lieth W.S.W. off the Point of *Noman's-land*.

Also from *St. Hellens-Point* (if it be clear Weather that you can see it) there is a direct Mark (*viz.*) a piece of an old Castle heretofore called *Haslewood Castle*, standing on *Gilkeker-Point* (which of late is kept white;) keep *Gosport Church* and that both in one, or this Mark in the middle of the

the Wood about the Church, which sheweth with a Valley like a Saddle, and so you may run directly in without fear. Or if the Wind be so, that you are forced to turn it in, then you may turn the said Mark within two Sail's breadth of each end of the Wood. In the middle of the Channel is 18 fathom water; and if you bring the said Mark right under the North end of the Wood, you shall run in a middle Ground near the *Horse*, that hath not above 10 foot on it at low water, and hard Sand.

To sail within the Wight in thick Weather.

To sail between the *Main* and the *Wight* in thick Weather; borrow 6 Fathom of *St. Hellens*, and steer North-west by North, and N.N.W. from *St. Hellens*, Point, till you have 12 fathom, and then steer more westerly, as you find the depth; come no nearer *Noman's-land* than 9. or 10 fathom; in that depth you may keep along the *Wight* side, if the Wind be southerly; but if it be large, keep in 14 or 15 fathom, which is a good Birth from both sides, and so steer West by South, and W.S.W. as you find the depth, until you come to *Cows*. Note, that being about *Stonks Bay*, there will be less Water; if you go near to *Cows*, there you may anchor in 12 or 14 fathom in the midst of the Channel, where is good Owsey Ground.

Directions for Dover-Road.

The best Ground in *Dover-Road*, is with the *White-way*, to the N.W. of *Dover Castle*, or between that Hill that comes from *St. James's Church*, which is a flat Steeple at the North end of *Dover Town*, for a thwart Mark, and in what depth you please, from 7 to 14 fathom. Thwart of *Foulstone* in 12 or 14 fathom, is very good Ground.

Directions to sail from the North Foreland through the Gulls in the Night.

If the Ground Tackle should fail in the Night, riding at the *North Foreland*, as very often has happened, and you cannot weather the *Foreland*, weather the *North-sand-head*; if you can but see the *North Foreland Light*, when that Light-house bears N.W. or N.W. by N. then bear over into 8 or 9 fathom; and being in that depth, (steering to the Southward S.S.W.) you may be sure it will carry you directly through with the *Brake*; but keeping your Lead carefully, and borrowing no nearer the *Brake* than 5 fathom, nor going without 9 fathom, or 9 and a half, as you have the Tide under you; this Course will lead you through without Danger.

Directions for the North-end of the Goodwin, for such as sail from the North-Foreland, to the Southward, in the Night.

If you be at *North-Foreland*, bound for the *Downs*, and that the Tides do fall out too early, or too late, to turn into the *Downs*, with the Wind at S.W. or S.S.W. take the following Directions.

If it be in the Morning before Day, then be sure to weigh Anchor in convenient time, to be at the *North-sand-head* at the turning of the Tide to
the

the southward. From the *Foreland* you may steer out with a Flood-Tide S.E. by E. and S.E. or keep the light of the *North Foreland* N.W. by N. this Course will lead you out: But for the more certainty, be sure to keep the Lead well, and then you may borrow off and on with the aforesaid Winds, in 7 or 8 fathom; and steering out in the aforesaid Course, you shall find the depth suddenly change to 15 or 20 fathom; then you may hale up close to the Southward along the back of the *Goodwin*, the Eastermost side of which lies S.S.W. and N.N.E. 12 or 14 fathom, and is not above a Saker-shot from the Sand. But if it be in the Day-time, and the Winds blow so hard that you cannot well tack to run through the *Gulls*, then the Marks to carry you out at the *Northsand-head*, is the flat Church upon the *Foreland*, called *St. Peters*, a Ship's length to the northwards of *Broadstairs* Peer-head; or borrow upon the Sand by the Lead as aforesaid, and so taking the first of the Tide without the Sand, you may stand to the South eastwards, till the *South Foreland* bears West by South; then cast about, and you shall weather the *Southsand-head*, and be in the *Dover* Road before any other Ship that parted with you at the *Foreland*.

Directions for sailing over the Spits, the Waller, and by the Naze into Harwich.

Harwich being a good and convenient safe Harbour, and much frequented by those that use the Northern Navigation, and a place where many times Ships are forc'd in by bad Weather. I shall here give such Directions as will carry any Stranger in.

Sailing down the *Swin* or *Kings Channel*, and that you would sail into *Harwich* over the Buoy of the *Spits* into the *Waller*, you must observe your Tides, for at the *Spits* the Buoy lieth in 5, 6, and 7, foot water at Low-water; and the Passage often alters, sometimes more Water, sometimes less: The Buoy lieth on the West-end of the *Gunfleet* Sand, and the East-end of the *Buxey*, bearing from a flat Steeple, called *Great Holland Church*, South by East. Being over the *Spits*, you come into the *Waller*, where is very good anchoring in five, six, seven, and eight fathom Water; the Sands lying without making it a most excellent Road. There is a good and deep Channel to sail into the *Waller* between the *Gunfleet* and the *West Rocks*, but 'tis seldom used. Being over the *Spits* into the *Waller*, steer away for the *Naze*, which may be known by the Trees, and a House that standeth on it, keep about half a Mile, or a Mile off from the *Naze*, to avoid the Stone Banks which have but 5 foot water at low water, and lie from the *Naze* Trees East by North. About a Mile and a half from the *Naze* Point there is but eight or nine foot water between it and the *Naze* at Low-water; keep *Payn's Trees* (which lie a little to the southward of *Harwich*) open and shut with *Harwich-Cliff*, and this Mark will carry you on the Stone-banks and the Trees on the *Corkland*, just open of the *Nazeland*, will carry you on the Bank also. There is a good leading Mark to carry you between the *Naze*, and the Stone bank, which is *Harwich Steeple*, or *Harwich Beacon Cliff*; and will also carry you between *Pye-sand* and the Ridg
into

into the *Rowling-Ground*, where Ships anchor in 3 and 4 fathom at Low-water. The Mark to anchor in the best of the *Rowling-Ground*, is to bring *Harwich Windmill* two Sails breadth open of *Harwich Cliff*: And to sail from the *Rowling-Ground* to the *Naze*, keep *Payn's Tree* open of *Harwich Cliff*, till you bring the *Naze* to bear S. W. then keep *Harwich Steeple* on the *Beacon Cliff*, to run within the Stone bank. There is a Channel to sail from the *Naze* between the Cork-land and the Ridg, keeping the *Naze Trees* S.W. sailing down N.E. between the Cork and the Ridg in 5, 6, and 7 fathom water: And when you have brought *Harwich Steeple* on the *Brewhouse* that lieth to the Northward of *Languard Fort*, then are you clear of the Cork Ledge; this Channel is much used by light Colliers going to the Northwards.

Being in the *Rowling Grounds*, and that you will sail into *Harwich Harbour*, keep close by the *Andrews*, which is a Sand that lieth off from *Languard Fort*, and is steep too on the west side; the Tide of Ebb runneth strong over the *Andrews* the first half Ebb, of which you must have a care: This Sand is dry at Low-water; keep close by the Beach of *Languard Fort*, to avoid the Alter, which is a small stony Shelf that lieth right west from *Languard Fort*, about a Cable and halfs length from the Beach at the Fort, on which is but 5 and 6 foot at low water; you may sail to the Westward of it, between it and *Harwich-Cliff*, according as the Tide is up, and what Draught of water your Ship draweth: But if you should chance to go into *Harwich* at low water, and your Ship draw above 15 foot, you must stay for the Flood to have water over the *Glutton*, which is a narrow Ridg, and stretcheth off from the Beach thwart the Channel, a little within the *Brewhouse*, that is to the northward of *Languard Fort*: Being past the *Glutton*, you must keep close to the Beach, to avoid the Gristle that lieth in the middle between *Harwich* and the Beach of *Languard Fort*, on which is but 3 foot at low water; there is a small Channel between the Gristle and the Guard of 90 foot at low water; but when you have opened *Dover Court Church* off *Harwich Town*, then are you clear of the Gristle and Guard, and may anchor before the Town of *Harwich*, in 5 fathom water, run up into *Ipswich* water, and anchor; this is a very safe Harbour, and if a Ship chance to blow a-shore, she cannot take harm, the shore being soft Owse. It flowereth here at full and change in the Harbour South; the Spring Tides rise 15 and 16 foot, and Neap Tides 10 and 11 foot.

Directions to sail into Harwich through the Sled-way.

Being at the Buoy of the *Spits*, and will not sail over the *Spits*, then keep down by the *Gunfleet Sand* in 7 and 8 fathom water, till you come within 2 Miles of the Buoy of the *Gunfleet*, and then come no nearer than 9 fathom water, for there lieth off a *Spit*, E.S.E. from the Sand; about a Cable's length to the Eastward of this *Spit*, is a small Swatch through the Sand; into which, and *Goldermores-Gat*, the Tide of Flood setteth strong into the *Waller*, of which you must have a care when you come near it, especially

144 To sail into some Principal Harbours, &c.

especially in little Wind or Calm, you may be hail'd on the *Gunfleet Sand*; this Sand lieth N.E. and S.W. and drieth in several Places: The Buoy of the *Gunfleet* beareth from the *Naze* S.E. by E. Easterly; you may stand into 7 and 8 fathom along the side of the West Rocks into the *Sledway*, keeping *Balsay-Church* N. by W. and N. N.W. till you bring *Harwich-Steeple* on the *Brewhouse*, (that lieth to the northward of *Languard-Fort*) which will carry you clear of the *Cork-Ledg.* on which is 2 fathom and a half at low water; and then stand to the westward, and keep *Orford Church* and *Castle* open of *Balsay Cliff* a Sail's breadth, till you have the *Lights* together, keeping them so till you are past the *Andrews*, and then follow the former Directions for sailing into *Harwich*: You may stand in upon the *Platters* into 5 fathom, on which Sand is but 2 or 3 foot at low water; the *Ridg* hath 7 foot at low water; a great part of the *Cork Sand* drieth at low water, and lieth in length N. E. and S. W. about 2 Miles and a half, and a Mile broad; *West Rocks* lie in length N. E. and S. W. about 3 Miles, and 2 Miles broad, and drieth in several Places, full of Banks and Swatches, the Ground rocky and stony in many Places; there's a small narrow Channel between the *West Rocks* and the *Cork*.

FINIS.

ADVERTISEMENT.

IN *Prescot-street* in *Goodman's-fields.* are Taught these Mathematical Sciences, viz. *Arithmetick, Geometry, Algebra, Trigonometry, Navigation, Astronomy, Gunnery, Surveying, Gauging, Dialling, the Use of the Globes,* and other Mathematical Instruments, *Projection of the Sphere,* and other Parts of the Mathematicks,

By *John Colson.*



